IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF OREGON

PORTLAND DIVISION

UNITED STATES OF AMERICA, Plaintiff, v. W. JOSEPH ASTARITA, Defendant.	Case No. 3:17-cr-00226-JO May 22, 2018 Portland, Oregon

EVIDENTIARY HEARING - DAY 2

Pages 198 - 425

TRANSCRIPT OF PROCEEDINGS

BEFORE THE HONORABLE ROBERT E. JONES

UNITED STATES DISTRICT COURT SENIOR JUDGE

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INDEX

TRANSCRIPT OF PROCEEDINGS

(May 22, 2018)

(In open court:)

THE COURT: Good morning, everybody. Have a seat. We've got where we left off.

VICTORIA DICKERSON,

called as a witness in behalf of the Plaintiff, being previously duly sworn, is examined and testified as follows:

DIRECT EXAMINATION

BY MR. SUSSMAN:

Q. Ms. Dickerson, when we broke for the day yesterday, I think you were describing for us how -- you were describing for us how you measured the horizontal azimuth angle of impact "W" to LaVoy Finicum's truck. Will you recap that again for us, please?

A. Sure. I measured it using ballistic trajectory rods and a centering cone, and then I was talking about how I used a protractor and the raised ridges on the top of the roof, placed the protractor on that raised ridge that had a parallel line, and measured where the trajectory rod intersected that protractor.

Q. And were photos taken of that process?

A. Yes.

Q. Do you have the exhibit notebook in front of you?
A. I do.
Q. And could you open that, please, to the tab under your name. The sub tab of exhibits, and we're looking for Exhibit DH11.
THE COURT: I have it.
THE WITNESS: Okay.
BY MR. SUSSMAN: (Continuing)
Q. Do you see that in front of you?
A. I do.
Q. What is Exhibit DH11?
A. That is a picture of the protractor along that raised ridge --
Q. Okay.
A. -- with the centering cone in place, the ballistic rod, and it's all on the roof of the vehicle.
Q. And the raised ridge, as you're talking about there, that's done as part of the manufacturing process?
A. Correct.
Q. And there's several of them that run parallel?
A. Correct.
Q. Along -- in a relatively straight line from front to back?
A. Right. Parallel along the roof of the vehicle.
Q. And the enlarged version that we're looking at there shows the rod inserted into impact hole "W"?

A. Yes.
Q. And the triangle-shaped thing at the end is what you've been calling the centering cone?
A. Yes.
Q. And what did you measure the horizontal azimuth angle at?
A. That angle was measured as 35 degrees left of midline.
So, again, if you're looking at the passenger's side of the truck, there's a line coming directly out at you at 90 degrees, and that angle was measured to the left of that 90-degree line.
Q. So that 90-degree midline that you're using is actually perpendicular to the front to back of the truck?
A. Perpendicular to that passenger's side, yes. Coming straight out the passenger's side.
Q. So then if you start -- if that's midline, you're saying that the horizontal azimuth angle was an additional 35 degrees to the left of it as you're looking at the truck from the passenger's side?
A. That's correct.
Q. And if we're using -- if -- we're calling -- if we call the front of the truck zero degrees, what, then, would be the horizontal azimuth angle from that? Would it be 90 plus 35?
A. Correct. So 125 degrees.
Q. Okay. And what was the vertical angle that you measured?
A. 20 degrees downward.

Q. How did you measure the vertical angle?
A. That was measured with an inclinometer.
Q. Can you take a look at Government's Exhibit DH10, please? It's the preceding page.
A. Yes.
Q. What is Exhibit DH10?
A. That's showing the inclinometer in place on the rod.
Q. And that's what you used to obtain the vertical angle?
A. Correct.
Q. And are Exhibits DH10 and DH11 fair and accurate representations of the measurements that you took of the horizontal azimuth and vertical angle?
A. Yes.
MR. SUSSMAN: We would offer DH10 and -011, Your Honor.
THE COURT: Received.
BY MR. SUSSMAN: (Continuing)
Q. Now, what rate of error did you use for your vertical angle and your horizontal azimuth angle measurements?
A. Plus or minus 5 degrees.
Q. Is that a standard rate of error that's used by experts in the field of ballistic trajectory measurements?
A. It is.
Q. Is there any reason you're aware of why that standard error rate of plus or minus 5 degrees would not apply to impact

"W"?

A. No. No. Sorry.

Q. Once the ballistic rod was in place, did you try to then estimate what path the bullet would have taken if it had continued in a straight line trajectory through the cab of the truck?

A. Yes, I did.

Q. How did you do that?

A. Can I stop for one second? I know there's things coming up on the screen. This screen doesn't have any picture on it.

Q. Nor does ours at the moment.

A. Okay. Earlier, it didn't either.

Sorry. Can you ask me the question one more time?

Q. Sure. How did you go about measuring that continuing trajectory?

A. So what we did is we extended the ballistic --

THE COURT: You're better off to speak into the mic. You don't have to turn around to talk to me. That's okay.

THE WITNESS: Okay. We extended the ballistic rods. And then, because they would have extended out the window -- we weren't able to just place them in the window because it didn't exist anymore, so we kept the rods at the 20-degree downward angle and then showed where it would have been had it extended out the window.

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BY MR. SUSSMAN: (Continuing)

Q. Take a look at Government's Exhibit DH12, which is on the screen in front of you there. What is Exhibit DH12?

A. Still not on the screen. This screen is not working.

Q. Do you have the paper copy, in any event?

A. Yes. The paper copy shows the rods are extended at the 20-degree angle, and at that point the rod exits out the lower side of that rear driver's side window.

Q. So do these ballistic rods somehow attach to one another or screw together so you can extend the length of them?

A. Yes. The rods screw together.

Q. And so did you -- how many extensions did you put out on the ballistic rod to get it to go out through the window?

A. I don't remember that exactly. Based on the picture, it looks like three, perhaps.

Q. Okay. And what we're seeing with the gloved hand there is the inclinometer at the same angle as you measured the inclinometer out of the roof of Mr. Finicum's truck?

A. Correct.

Q. Now, are you saying that the bullet, in fact, continued in a straight line through the truck and, in fact, impacted the rear window on the driver's side?

A. No. That was done for demonstrative purposes only, saying if the bullet had continued in a straight line, that's where it would have exited. It's certainly possible that some

deflection occurred. It's likely that some deflection occurred. But that's done for demonstrative purposes, to show that that is the general area where it would have likely exited.

Q. But you don't know if, in fact, it did impact the window?

A. Right.

Q. And you're not claiming that it, in fact, impacted the window?

A. Correct.

Q. All right. I want to talk for a bit about exactly what your vertical angle measurement was measuring.

Now, in Exhibit DH10, we saw a picture of an inclinometer attached to the ballistic rod; right?

A. Correct.

Q. And that ballistic rod was placed in the centering cone, through the hole in the roof, and through the three layers of material in the headliner?

A. Yes.

Q. So, in fact, you were measuring the angle of the path that the bullet took after it impacted the roof and as it traveled through the headliner layers into the cab of the truck?

A. That's correct.

Q. And is that necessarily the same vertical angle that the bullet was traveling at at the moment it first impacted the roof?

A. It's possible that there could have been some vertical deflection, and so potentially those angles could be slightly different.

Q. And would the use of the centering cone have affected the accuracy of either the horizontal azimuth measurement or the vertical angle measurement?

A. The centering cone can push the rods slightly upward a little bit outside of the bullet path, so it's possible that it would slightly affect the vertical angle but not the horizontal azimuth angle.

Q. Are you familiar with Michael Haag?

A. I am.

Q. Is he widely regarded among forensic scientists as an expert in ballistic trajectory measurement and shooting reconstruction?

A. Yes.

Q. In fact, have you received training from Mr. Haag?

A. Yes.

Q. Are you familiar with what he calls the rocker point method of measuring trajectory and low-angled bullet impacts such as impact "W"?

A. Yes.

Q. Have you received training in that method of measuring trajectory and low-impact bullet impacts -- low-angled bullet impacts?

A. Yes.
Q. From Mr. Haag?
A. Yes.
Q. Now, had you received that training when you examined the Finicum pickup truck, beginning on January 28 of 2016?
A. No, I had not.
Q. But you're familiar with the rocker point method now?
A. Yes.
Q. Based on your training and experience as a forensic scientist, do you believe that it's a reliable method of measuring trajectory and low-angled impacts, such as impact "W"?
A. Yes.
Q. Have you used that method yourself since being trained in it?
A. Yes.
Q. Have you found it to be reliable and accurate?
A. Yes.
Q. Would you use it in each and every instance when you're measuring trajectory?
A. No.
Q. When would it be appropriate to use the rocker point method?
A. Most commonly, it would be used in shallow-angle impacts, for instance, on sheet metal, and usually when there's only one

point of impact.

So, for instance, if a bullet enters a hood of a vehicle and then doesn't actually perforate through anywhere else, so you only have that single impact into the hood, if it's a shallow enough angle, you can use the rocker point method to measure that angle.

Q. Now, you mentioned just a minute ago that using a centering cone can affect the accuracy of the vertical angle measurement in an impact such as impact "W."

A. Yes.

Q. Do you now believe that in this particular case using that centering cone may have, in fact, affected the accuracy of the vertical angle measurement?

A. I think it slightly could have elevated it.

Q. But would using the centering cone have affected the horizontal azimuth angle at all?

A. No. The centering cone would not have affected the horizontal azimuth angle.

Q. Do you have any reason to doubt the accuracy of your horizontal azimuth measurement in this case?

A. No.

Q. And there's been some discussion in this case about the truck settling after it came to rest in the snow but before you measured the angle at which it was sitting.

Now, when you observed it, the truck was angled downward

toward the passenger's side at an angle of about 14 to 15 degrees?

A. Yes.

Q. Assuming it settled downward toward the driver's side over time, would that affect your measurement of either the vertical angle or the horizontal azimuth angle of impact "W"?

A. If it settled down towards the driver's side, that could affect the vertical angle or what -- it could affect the area of origin of where that trajectory came from.

If my angle -- when I measured it, the truck was obviously leveled. So if it was angled at a different angle, then I wouldn't have known -- I wouldn't have known what that angle was if it had settled.

Q. Would that have affected the trajectory measurements at all? The way you took the measurements.

A. No. Not the way I took the measurements.

Q. Now, did you examine the inside of the truck cab for bullets or bullet fragments?

A. Yes.

Q. Did you find either a bullet or bullet fragments anywhere inside of the truck's cab?

A. No.

Q. Or in the headliner material?

A. No.

Q. In fact, did you cut open the headliner material looking

for bullet fragments?
A. Yes.
Q. But you didn't find any?
A. No.
Q. How about the rear driver's side door?
A. We did not disassemble the rear driver's side door; but we did examine it, and we did not find any.

MR. SUSSMAN: That's all I have. Thank you.

THE COURT: Will you introduce yourself again.

MS. FERGUSON: Yes.

CROSS-EXAMINATION

BY MS. FERGUSON:
Q. Good morning, Ms. Dickerson. My name is Meghan Ferguson, and I represent the defendant in this case.
A. Good morning.
Q. We passed out some binders, which I think you now have in front of you, which we'll be using for this cross.

I want to start out by discussing your examination of Mr. Finicum's truck at the Oregon State Police Forensic Lab in Bend on January 28, 2016.
A. Okay.
Q. Mr. Brian Medlock and Mr. Devon Mast assisted you in that examination; correct?
A. Correct.

Q. And your examination of that truck continued on January 29, 2016; correct?
A. That's correct.
Q. And over the course of those two days, you estimated several different bullet paths; correct?
A. Yes.
Q. And you used different methods to estimate those bullet paths; correct?
A. I used bullet -- ballistic rods for three of them, and I used a laser for one of the bullet paths.
Q. But in your use of the ballistic rods, you used different methods; correct?
A. Yes.
Q. For example, for impact "T" to the hood, you used a trajectory rod without a centering cone; correct?
A. Correct.
Q. And for impact "W" to the roof, by contrast, you used a centering cone to hold that rod in the center of an oversized hole?
A. Yes.
Q. And you applied an uncertainty cone of plus or minus 5 degrees to each of the bullet paths that you estimated?
A. That's correct.
Q. And you applied that cone regardless of the differences between the trajectory methods that you used; correct?

A. Yes. I felt it was an appropriate uncertainty for both holes. They appeared different, but the uncertainty was -- was consistent with both holes.

Q. Can you please turn to Tab 1 in the binder? Do you recognize that document?

A. The declaration of Bruce Koenig? I do not.

Q. I think we may have given the wrong binder.

Ms. Dickerson, do you recognize Tab 1 in the new binder that we've handed you?

A. I do.

Q. Is that binder your notes?

A. It is.

Q. And are those notes dated January 28, 2016?

A. Yes.

Q. And do those notes discuss impact "T" in this case?

A. The top portion, yes.

Q. And is impact "T" located on the hood of the Dodge Ram truck?

A. Yes.

Q. And did the bullet perforate the sheet metal?

A. Yes.

Q. And you marked the entry side of that impact "T1"; correct?

A. Yes.

Q. Can we show that on the -- on the screen?

MS. OAKLEY: Which one?

MS. FERGUSON: We want to show T1.

MR. SUSSMAN: Are you okay, Meghan?

THE COURT: What happened? Oh, dear. Call 9-1-1.

(Pause-in-proceedings.)

THE COURT: Counsel, go ahead with your next question.

BY MS. FERGUSON: (Continuing)

Q. Ms. Dickerson, we're looking at your notes from Mr. Finicum's truck; correct?

A. Correct.

Q. And as your notes indicate at the top of the page, impact "T" is located on the hood of the truck; correct?

A. Correct.

Q. And the bullet that caused impact "T" perforated the sheet metal of the hood; correct?

A. Yes.

Q. And as your notes indicate, you marked the entry side of the metal perforation as "T1"; correct?

A. Yes.

Q. And after perforating the sheet metal, that bullet continued through a fibrous liner inside the hood; correct?

A. Yes.

Q. Which you marked as "T2"?

A. Yes.

Q. After perforating that fibrous liner, the bullet continued into the engine of the truck; correct?
A. Into the radiator hose.
Q. Is the radiator hose inside of the engine of the truck?
A. Inside. Yeah, inside the hood.
Q. Okay. And that bullet perforated that radiator hose fully; correct?
A. Yes.
Q. And you believe that that bullet then struck a piece of black plastic below the windshield; correct?
A. Yes.
Q. And you marked that spot with "T4"; correct?
A. Yes.
Q. And so, in all, you observed three different complete perforations associated with impact "T"?
A. Yes.
Q. So the first perforation was through the hood metal?
A. Yes.
Q. And the second perforation was through the fibrous liner?
A. Yes.
Q. And the third perforation was through the radiator hose?
A. Yes.
Q. And you used all three of those perforated -- perforations to estimate the bullet's flight path; correct?
A. I believe so, yes.

Q. Now, if you look down towards the middle of the page, do you see your notes on impact "W"?
A. Yes.
Q. And that impact was located on the roof of the truck; correct?
A. That's correct.
Q. And that bullet perforated the sheet metal which you marked the entry side as "W1"; correct?
A. Yes.
Q. And then you got into the backseat of the truck to examine the roof headliner?
A. Yes.
Q. And you marked the holes in the roof liner as "W2"?
A. Correct.
Q. So these two defects, "W1" on the outside of the roof and "W2" on the inside of the roof, those were separated by a layer of fiberglass, a layer of foam, and a layer of fabric; correct?
A. Yeah. I have two different layers of foam, actually.
Q. Okay. But you would agree that these -- these four layers were all that separated "W1" and "W2"; correct?
A. Yes, that's correct.
Q. Okay. Can we move to Tab 2, please, in your binder?
And Tab 2 is a photograph of impact "T" on the hood; correct?
A. Yes.

Q. And can you turn to Tab 3?
That's a closeup of impact "T"; correct?
A. Yes.
Q. And that impact has a circular shape?
A. Somewhat. Somewhat circular. Partially elliptical.
Q. Okay. And that -- that somewhat circular shape is 6 millimeters in diameter; correct? Approximately?
A. It looks maybe slightly -- slightly more than 6 millimeters.
Q. Okay. And is the metal pushed inward at both ends of that defect?
A. Yes.
Q. And can you turn to Tabs 4 and 5 in your binder? Do you recognize those photographs?
A. Yes.
Q. Do you recognize those photographs as the perforation on the inside of the hood of the fibrous liner?
A. Yes.
Q. And can you turn to Tab 6 and 7 in your binder?
A. Yes.
Q. And do you recognize Tabs 6 and 7 as photographs of the perforation through the hose and the impact point in the black plastic?
A. Yes.
Q. And you -- those were the ones that you marked "T3" and

"T4"; correct?
A. Yes.
Q. Can you turn to Tab 8 in your binder, please?
A. Yes.
Q. So you placed a pink trajectory rod into "T1"; correct?
A. Yes.
Q. And the diameter of that rod is approximately six millimeters; correct?
A. I don't know the diameter of that rod offhand.
Q. Well, does that rod look like it's fitting into that hole that you said was slightly larger than 6 millimeters?
A. Yeah, it's fitting into it.
Q. So the size of the defect and the size of the rod were about the same; correct?
A. Yes.
Q. And you did not need to use a centering cone to stabilize that rod, that size rod in that size hole; correct?
A. Yes, that's correct.
Q. And you first passed the rod through "T1" in the sheet metal; correct?
A. That's correct.
Q. And you next passed the rod through "T2" in the fibrous liner; correct?
A. Yes.
Q. And then you -- did you pass the rod through the radiator

hose as well?
A. I believe we did. I don't have specific notes that we entered -- that the rod entered into the radiator hose, but I'm fairly confident that it then entered that radiator hose.
Q. So at that point that rod was held firmly in place in three different perforations; correct?
A. Yes.
Q. And there was no need to use a centering cone to stabilize that rod; correct?
A. That's correct.
Q. And there was no need for anyone to hold that rod in place?
A. Also correct.
Q. There was no need to tape that rod into position; correct?
A. Correct.
Q. And that rod was stabilized by the shape of those perforations themselves?
A. Yes.
Q. Can you turn to Tab 11 in your binder, please?
And that's a photo of impact "W" in the sheet metal of the roof of Mr. Finicum's truck; correct?
A. Yes.
Q. And this hole we see here is not circular; correct?
A. Correct.
Q. This hole is about 10 millimeters in width?

A. That looks about right.
Q. And it's about 20 millimeters in length?
A. Again, yes, based on the photos, that looks approximately correct.
Q. And your report does not note the dimensions of impact "W,"; correct?
A. That's correct.
Q. And you also see a 1-centimeter strip of white paint on the entry side of this defect?
A. Yes.
Q. And this is an unusually long example of a pinch point; correct?
A. Yes. I said it was somewhat atypical.
Q. And your report does not mention this feature of impact "W"?
A. That's correct.
Q. Do you see that there's an upward push of metal opposite the pinch point?
A. Yes.
Q. Your report does not note this feature of impact "W"; correct?
A. That's correct.
Q. Do you see that the overall shape of this defect looks like a keyhole?
A. Somewhat as a keyhole. This isn't exactly what I would

describe as a keyhole, but it has an elliptical shape, and then it has that bulge at the end that you talked about.

Q. And your note does not note the bulge at the top of impact "W"; correct?

A. That's correct.

Q. Can you turn to Tab 12 in your binder, please?

Is this a photo of the defect that you marked in the headliner of Mr. Finicum's truck?

A. It is.

Q. And you can see in this photo that there's not just one hole in the fabric; correct?

A. Yes.

Q. There are at least three holes that are visible in this photograph?

A. There's at least one large hole, and then there's some other, at least, partial tears. I can't tell if there's -- if those two that are highlighted completely go all the way through, but there's at least some defects. At least three defects.

Q. And your report does not note the fact that there are three defects as part of your description of "W"; correct?

A. Probably not three specifically.

Q. Was there anything between "W1" and "W2" other than a layer of fiberglass, two layers of foam, and a layer of fabric?

A. I don't believe so. We stopped cutting at the layer of

foam, the thickest layer of foam, and I believe that was adjacent to the sheet metal. But I don't know for sure what the construction of that material is.

Q. Can you turn to Tab 13 in your binder?

Is Tab 13 a photograph of the yellow trajectory rod that you inserted all the way through the roof of Mr. Finicum's truck?

A. Yes.

Q. Okay. And the rod is shown here with all of its extension parts; correct?

A. Yes.

Q. And it's shown being stabilized by a blue gloved hand; correct?

A. Correct.

Q. Let's turn to Tab 14 in your binder. And I want to talk about the process that you used to place this trajectory rod in the roof of Mr. Finicum's truck.

So I believe you testified yesterday afternoon that first you put the rod into the hole without using any centering cone; correct?

A. Yes. That's our standard practice.

Q. And when you did that, you could wiggle that rod around in that hole; correct?

A. Yeah. I don't remember specifically; but, ultimately, if we're unhappy with how the rod fits in the hole, then we try an

alternative approach, which, in this case, was the cone. So I don't have specific recollections of how much I could wiggle it, other than we weren't satisfied with how the rod fit.

Q. And you weren't satisfied with how the rod fit because that hole, as you testified, is about 10 millimeters in diameter; correct?

A. Based on the photographs, that looks approximately true.

Q. And that rod is only 6 millimeters in diameter; correct?

A. Again, I'm not positive how many millimeters that rod is. The pink rods and the yellow rods are different diameters in our kits. And I'm not positive how much this one is, but it is slightly bigger than that pink rod.

Q. But you would agree that the diameter of the hole was larger than the diameter of the rod; correct?

A. Correct.

Q. And so when you could wiggle that rod, you could wiggle it not only up and down but also side to side; correct?

A. I would say that's correct.

Q. And so you had to use a centering cone to hold that rod in place?

A. Yes.

Q. And that centering cone resolved the wiggle issue by holding that rod in the center of that defect?

A. Yes.

Q. So that rod, now centered in that cone with the centering

cone, represents the bullet flight path that you measured with a protractor and an inclinometer?

A. Yes.

Q. So by using that cone, you were, by definition, assuming that the bullet ran through the center of that defect; correct?

A. Yes.

Q. And not through the lead-in portion of that defect; correct?

A. The -- by using the cone, the rod still passed through the pinch point and lead-in mark, so it's still aligned with that. Just slightly above it.

Q. So is the pinch point located on the surface of the metal?

A. Yes.

Q. And the rod is not touching the surface of the metal; correct?

A. Right. Hovering above it.

Q. The rod is touching the centering cone; correct?

A. Yes.

Q. Is the centering cone touching the pinch point of the metal?

A. I'm trying to find a better picture of that. I'm not seeing a very good picture of that. I think that the cone is -- the cone rests through the hole, and I believe it is somewhat touching the pinch points, but I can't -- I can't tell from these photos.

Q. Is the pinch point located before the hole?
A. Just before the hole.
Q. Okay. Can you turn to Tab 15 in your binder, please?
A. Yes.
Q. And does this show the tip of the yellow rod coming through what you marked as "W2"?
A. Yes.
Q. And that rod is being held in place between two very close points in this photo: "W1" and "W2"; correct?
A. Yes.
Q. And you would agree, Ms. Dickerson, that these two points that are holding this rod in place are -- are separated only by a layer of -- two layers of foam, a layer of fiberglass, and a layer of fabric; correct?
A. Again, those are the layers that I was able to see, but we stopped cutting at that layer of foam. So if there's other construction materials in the inner part of it that I'm not aware of, that they could be there, but that's what I'm aware that it's passing through.
Q. And you would also agree that two defects that are very close together are unreliable in providing a shot estimate; correct?
A. I wouldn't agree to that.
Q. Can you turn to Tab 22 in your binder, please?
Do you recognize the cover of this book?

A. Yes.
Q. Do you have a copy of this book?
A. I'm not sure that we do.
Q. Okay. How do you recognize the cover of this book?
A. I've heard of this book before, but I'm not -- I'm not sure if we have a physical copy of it.
Q. Okay. And can you turn to the third page of this document, which is the 49th page of this book.
Do you see that the caption of this image, of this page of this book, states that "Two defects that are very close together are unreliable in providing a shot angle estimate."
A. Yes.
Q. And do you see that the caption inside the picture that states, "When two defects are this close together, a quarter-inch error throws off the angle measurement"?
A. Yes.
Q. Can you turn to Tab 19 in your binder?
Do you recognize the document at Tab 19?
A. Yes.
Q. How do you recognize it?
A. It's a page out of my notes. It has my initials on it.
Q. Okay. And this page contains four different red lines; correct?
A. Yes.
Q. And it contains eight different yellow lines; correct?

A. Yes.
Q. And the red lines represent the flight paths that you estimated for each of these bullet impacts; correct?
A. Very approximate, yes.
Q. And the yellow lines represent a plus-or-minus-5-degree uncertainty cone around each of your estimated flight paths; correct?
A. Yes.
Q. You applied the plus-or-minus-5-degree uncertainty cone to the flight path that you estimated for impact "T"?
A. Yes.
Q. You also applied that same cone to the flight path you estimated for impact "W"?
A. Yes.
Q. But for impact "T," you stabilized a trajectory rod between three separate perforations, and you did not use a centering cone; correct?
A. That's correct.
Q. And for impact "W," you had to stabilize the rod with a centering cone; correct?
A. Correct.
Q. But despite your use of these two different methods, you treated the plus-or-minus-5 uncertainty cone as a one-size-fits-all standard; correct?
A. The plus-or-minus-5-degree cone applies across a variety

of trajectory measurement types, so it was applicable to both "T" and "V" [sic] despite the fact that I used two different methods.

Q. Your report makes no mention of the plus-or-minus-5-degree uncertainty cone; correct?

A. That's incorrect. I believe it's a footnote in my report.

Q. Your report makes no mention of the reasons why you applied the plus-or-minus-5-degree uncertainty cone to both impact "T" and impact "W"; correct?

A. That's correct.

Q. Can you turn to Tab 21 in the binder, please?

This is a copy of your CV; correct?

A. Yes.

Q. And in October of 2016, you took a course entitled Forensic Shooting Incident Reconstruction?

A. Yes.

Q. And that course was taught by Mike Haag and his father Luke Haag?

A. Yes. Primarily, Mike Haag. And Luke Haag was also present for some of it.

Q. And that was a three-day course?

A. Yes.

Q. And that course involved a lecture component?

A. Yes.

Q. And that course also involved a demonstration component?

A. Yes.
Q. And did Mr. Haag demonstrate the centering cone method during that course?
A. I don't specifically recall him doing that. He may have.
Q. Mr. Haag did demonstrate the rocker point method during that course; correct?
A. Yes.
Q. And before you took his course, had you read Mr. Haag's *Shooting Incident Reconstruction* book?
A. At least portions of it, yes.
Q. And that book does not describe the rocker point method; correct?
A. I don't believe it uses the specific term "rocker point method" in it.
Q. And no written material from the course that you took with Mr. Haag in 2016 describes the rocker point method; correct?
A. I have that in notes that I took during the course. I believe that I discussed the rocker point method. Most of the things that he provided were electronic. I don't remember a ton of -- I'm trying to remember if I got a binder or not. I don't remember a specific binder from that course.
Q. Did you provide any of that material to the prosecutors in this case?
A. No.
Q. Were you asked to provide any of that material?

A. No.
Q. And when you examined impact "W" in January of 2016, you were not aware of the rocker point method?
A. Correct.
Q. And you were not aware of that method through any of your casework as an Oregon State Police forensic examiner?
A. Correct. As I looked back through some of my training materials, we had some internal training that somewhat discussed it, but not really, and it was not a method that I would have used or was really aware of.
Q. And did you provide any of that internal training documentation to the government in this case?
A. No.
Q. You were not aware of the rocker point method before January 2016 through any of your colleagues in the Oregon State Police Forensic Laboratory; correct?
A. October of 2016. Not January of 2016.

And, again, like I said, as I looked through a couple of training materials, there was a brief discussion about something similar, and some of that was through my colleagues at the Oregon State Police; but, again, not specifically the rocker point method, not to the degree I'm aware of now. So, no.

THE COURT: Excuse me. Excuse me just a moment.

Dan, will you call Judge Brown and see if she can take

that plea for me at 10:30?

Thank you. Go ahead.

BY MS. FERGUSON: (Continuing)

Q. Ms. Dickerson, there are multiple Oregon State Police forensic in-service trainings listed on your CV; correct?

A. Yes.

Q. And you did not become aware of the rocker point method through any of those trainings?

A. Those in-services? No.

Q. And you did not become aware of the rocker point method through any of the FBI forensic academy trainings listed on your CV; correct?

A. Correct. I believe the only FBI trainings at the FBI academy, at least, involved digital imaging, so they weren't applicable to this.

Q. And you did not become aware of the rocker point method through any of the trainings listed on your CV other than the October of 2016 training; correct?

A. Primarily, yes.

Q. And you were not aware of the rocker point method before 2016 through any of the Pacific Northwest Division of the International Association for Identification conferences listed on your CV?

A. That's correct.

Q. And you were not aware of the rocker point method through

any of the American Academy of Forensic Sciences workshops listed on your CV?

A. Correct.

Q. And you were not aware of the rocker point method through any article published in the *Association of Firearm and Tool Mark Examiners' Journal?*

A. I'm not a member of that organization, so I don't get that journal, but I -- I'm not aware of any; but, again, I don't -- I don't get that journal.

Q. When Mr. Haag demonstrated the rocker point method to your class in October of 2016, what -- what kind of defect was he demonstrating that method on?

A. I can't recall that specifically.

Q. And you don't recall what kind of bullet made that defect?

A. No.

Q. And you don't recall what kind of impact surface it was?

A. We had two different vans, so sheet metal surfaces. And I'm quite sure he demonstrated it at the range when we were shooting those vehicles. So likely with that.

We also had a variety of mock walls made out of different materials, and I can't recall if the rocker point was ever used on any one of those.

Q. And you testified earlier today that you have used the rocker point method; correct?

A. I have.

Q. And when you used that method, do you use tape to secure the rod in the sweet spot of the rocker point?
A. No.
Q. Do you use a clamp to secure the rod in the sweet spot of the rocker point?
A. No. I held it.
Q. And how did you measure it?
A. There were two examiners present, so one of us held the rod and then the other examiner took the measurements.
Q. Ms. Dickerson, you testified yesterday that you serve as a technical lead for the Oregon State Police Forensic Lab; correct?
A. Correct.
Q. And in that role, you oversee certain standard operating procedures; correct?
A. Yes.
Q. And you also oversee the validation process when a new method is added to that standard operating procedure; correct?
A. Yes. Under the direction of a quality assurance manager, so there's somebody above me.
Q. Okay. And the Oregon State Police Forensic Lab does not have an SOP that is specific to the centering cone method; correct?
A. That's correct.
Q. And the Oregon State Police Forensic Lab does not have an

SOP that's specific to the rocker point method; correct?
A. That's correct.
MS. FERGUSON: I have no further questions.

REDIRECT EXAMINATION

BY MR. SUSSMAN:
Q. Take a look at Tab 22 again in that black notebook, please. And on the third sheet, which is page 49 of that text, where the author says, "When two defects are this close together, a quarter-inch error throws off the angle measurement," how much -- how close together is "this close together" in that diagram?
A. It looks like a half an inch.
Q. And was the headliner material in Mr. Finicum's pickup truck only a half-inch thick from one side to the other?
A. I didn't take those measurements, but the way that the rod passed through the hole from the sheet metal through the headliner material and out, I believe is longer than a half an inch.
Q. Quite a bit longer than a half an inch?
A. Yes.
Q. In fact, when you passed the rod through defect "W", through the centering cone, through the headliner, there wasn't that much of the ballistic rod sticking out either through the roof on the outside or through the headliner on the inside, was

there?
A. Correct.
Q. In fact, in order to take the inclinometer measurement, you had to put an extension rod on the outside of the truck; isn't that correct?
A. That's correct.
Q. And you took the measurement in both the vertical angle and the horizontal azimuth before the extensions were run to carry the trajectory outside of the truck?
A. That's correct.
Q. And at the time you took the measurements, nobody had to handhold the ballistic rod, did they?
A. No.
Q. It sat there all on its own?
A. Yes.
Q. Through the centering cone?
A. Yes.
Q. Take a look at Government's Exhibit DH11, if you would, please.
A. Okay.
Q. DH11 shows the ballistic rod through the centering cone and into defect "W," does it not?
A. Yes.
Q. And there's a little metal band just at the edge of the protractor there. Is that where the connecting rod was screwed

into the original rod placed through the defect?
A. Yes.
Q. Through the centering cone?
A. Yes.
Q. And through the headliner material?
A. Yes.
Q. And this picture was taken essentially as an overhead shot directly over the -- well, pretty close to directly over the centering cone?
A. Yeah. Not directly overhead, but up above the centering cone.
Q. And when you placed that centering cone there and when you placed the rod through the centering cone, how did the rod line up with the pinch point and the rocker point?
A. It's directly above it. You can no longer see the pinch point and the rocker point because the cone is touching it or right above it.
Q. Okay. And would the centering cone affect the horizontal azimuth angle of the measurement at all?
A. I don't believe it did.
Q. It could have affected the vertical angle measurement?
A. It could have slightly elevated the vertical measurement.
Q. But not the horizontal azimuth?
A. No.
Q. And Ms. Ferguson asked you about applying the same

plus-or-minus-5-degree margin of error to all of the ballistic trajectory measurements you made in this case.

A. Yes.

Q. Did you see any reason, based on your training and experience as a senior forensic scientist at the Oregon State Police Lab, to have used a different margin of error on defect "W"?

A. No.

Q. Now, Ms. Ferguson asked you about running the ballistic rod with respect to impact "T" through several different holes in the hood and in the engine compartment.

A. Yes.

Q. And hole "T" is a little different in shape; in fact, it's quite a bit different in shape than impact "W," isn't it?

A. It is.

Q. Now impact "T" was essentially shot close to straight on and close to level; right?

A. I believe impact "T" was the 17 degrees azimuth angle but close to level.

Q. And it was -- it went through pretty much front to back on the truck?

A. Yes.

Q. So, in other words, that shot hit the truck as the truck was heading toward the shooter?

A. Yes.

Q. On the other hand, impact "W," you said, was shot from rear to front?
A. That's correct.
Q. At an angle?
A. Yes.
Q. A rather acute angle?
A. Yes.
Q. Both downward and horizontally?
A. Yes.
Q. So is it fair to say impact "W" and impact "T" are not -- are not an apt comparison in terms of bullet hole shape or bullet hole size?
A. Right. Ultimately, they're different.
Q. But, ultimately, you believe that the same plus-or-minus-5-degree margin of error would apply to both?
A. Yes.
Q. Can you take a look at Exhibit DH13, please?
A. Yes.
Q. What is Exhibit DH13?
A. That's a picture of the rods extending out the hole in the headliner and through the rear driver's side window.
Q. That was done after you took the horizontal and vertical measurements?
A. Yes.
Q. And after you put the extension rods on there?

A. Yes.
Q. At that point the rod is being held by someone standing outside of the vehicle?
A. That's correct.
Q. At that point there's nothing more for it to anchor through?
A. Correct.
Q. Ms. Ferguson asked you about there being several defects in the headliner which was shown in one of those tabs in her notebook that she looked at.
A. Yes.
Q. But you said that there was one larger hole.
A. That's correct. The hole that the rod is extending out of is the largest hole in that headliner.
Q. And, in fact, were you able to trace the ballistic rod right through defect "W" and right through the path that went through all of the layers of the headliner and out the largest hole?
A. Yes.
Q. With respect to the rocker point method, I think I heard you mention during cross-examination that you have seen some mention of similar techniques in some other publications but maybe using different terminology or a different name for it.
A. I'm not sure she said that, but that's -- that's somewhat true. I've seen at least one other source that talks about

holding a rod in essentially the front portion of the bullet hole, and there's another source that talks about -- uses the word "shoulder," and it's a little bit unclear as to what exactly the shoulder is, but it's a feature on the front edge of a bullet hole.

Q. But all of them are talking about measuring at the leading edge of a low-angle impact?

A. Yes. Those two sources that I just talked about, yes.

Q. By holding the rod against that leading edge or the pinch point or the shoulder or whatever the particular author happens to call it?

A. In those two cases, yes.

Q. They didn't call it the rocker point method?

A. No.

Q. But it's the same general technique?

A. I think it's -- one of them, I think, yes, specifically talked about a single impact and holding the rod in that area. The one with the shoulder, I'm still a little bit unclear as to what exactly that one means, but they're somewhat similar. They talk about the leading edge of the hole.

Q. And having been trained in the rocker point method yourself, do you now believe it's a reliable method for measuring low-angle impacts such as impact "W"?

A. Yes.

MR. SUSSMAN: Thank you. That's all I have.

THE COURT: Anything further?

MS. FERGUSON: Your Honor, I don't have anything further, other than to move for admission of the exhibits that I used in the binder with Ms. Dickerson.

THE COURT: They're all received.

MS. FERGUSON: Okay. Would the Court like me to name those now or -- okay. So those are 3-01. That's Tab 1 in the binder. 3-02, 3-03, 3-04, 3-05, 3-06, 3-07, 3-11, 3-12, -13, -14, -15, 3-19, -21 and -22.

THE COURT: Thank you.

MR. SUSSMAN: The government also moves in Exhibit DH13, Your Honor.

THE COURT: Thank you. All received.

You're excused.

We're ready for our next witness?

MR. MALONEY: We are, Your Honor.

THE COURT: Go ahead.

MR. MALONEY: The government calls Michael Haag. This witness may need a minute to set up the computer.

THE COURT: That's fine.

I told you I had another matter at 10:30. I got Judge Brown to cover it, so --

MR. MALONEY: Sir, can you stand and raise your right hand to be sworn, please.

DEPUTY COURTROOM CLERK: Sorry.

MICHAEL HAAG,

called as a witness in behalf of the Plaintiff, being first duly sworn, is examined and testified as follows:

THE WITNESS: I do.

DEPUTY COURTROOM CLERK: Thank you. Would you sit down, speak directly into the mic, and spell your first and last name for the record, please.

THE WITNESS: My name is Michael Haag. H-a-a-g. Common spelling of Michael.

DIRECT EXAMINATION

BY MR. MALONEY:

Q. Good morning, sir. Are you all technologically plugged in and ready to work up there?

A. I think so.

Q. Okay. What do you do for work?

A. Primarily, I'm a forensic scientist, specializing in shooting incident reconstruction.

Q. And prior to today's proceeding, did you and I review Defense Exhibit No. 1, specifically pages 14 through 32?

A. I would have to see that to remember those or what that actually is.

MR. MALONEY: May I approach the witness, Your Honor?

THE COURT: Of course.

THE WITNESS: I have seen this.

BY MR. MALONEY: (Continuing)

Q. And I've handed you a document that is ECF No. 80. Pages 14 through 32. What is that document?

A. That is a copy of my CV.

Q. Is it fair and accurate?

A. At the time it was filed, yes. I think there's probably more additions from the time that copy was given to you, but yes.

Q. For the persons of your testimony today, do you adopt that document?

A. I do.

THE COURT: His CV is received in evidence.

BY MR. MALONEY: (Continuing)

Q. I'm showing you a second document, also from ECF No. 80, pages 33 through 48. Do you recognize this document, sir?

A. I do.

Q. What is that document?

A. That is my report on this case.

Q. And for purposes of our proceeding today, do you adopt the contents of this document as your testimony?

A. I do.

MR. MALONEY: I move to admit his report, Your Honor.

THE COURT: Yes, it's admitted.

///

BY MR. MALONEY: (Continuing)

Q. Sir, how did you first become involved in this case?

A. I don't remember an exact date, but I believe I was contacted by you, Mr. Maloney, with regard to the trajectories. The interest, in particular, "W", but the Dodge pickup truck.

Q. Were you contacted by anyone else?

A. I was later on.

Q. Who were you contacted by?

A. An attorney with, I believe, defense counsel later on called me with interest in the case.

Q. And how did you respond to their inquiry?

A. As I remember, I was actually doing an examination at the time. And as the information or the general information about the case came into the discussion, I quickly realized that it was one I had already discussed with you and was retained on, and so I said, "I don't" -- "I can't help you."

Q. Okay. And what were you retained to do with this case?

A. The primary area of interest in this case for me was back-extrapolation of the trajectories; basically, trying to determine where firearms were, the general area, relative to a vehicle at the time shots were fired.

Q. Now, given that your report has been received and I believe the Court has reviewed those documents --

THE COURT: I have.

///

BY MR. MALONEY: (Continuing)

Q. I'm going to kind of jump ahead a little bit.

Did you bring the scan data that you collected as part of your investigation in this matter?

A. I did.

Q. Would it help illustrate your testimony to demonstrate that scan data for the Court?

A. Because scan data is very three-dimensional, it absolutely is helpful to see it live on the screen as opposed to still shots.

Q. Do you have that on your computer today?

A. I do.

Q. Can you display it for the Court, please.

A. (Witness complies.)

Q. And can you describe what we're looking at here.

A. This is not a computer-generated model. This is actually data points, which, if I zoom in, we can see this becomes individual points that have been measured by the scanner. When we back out, of course they become close together and visually look like a solid object. But this is in the vehicle in question, and there are line segments of colors blue, red, purple, and green that are placed relative to this vehicle that are based on my data and placement of trajectory rods in the vehicle.

Q. And how did you collect this data?

A. I collected it with a Leica C10 scanner by placing the scanner in multiple positions around the vehicle. Because it is a line-of-sight instrument, basically it only records what it sees, blending those scan holes together, looking at the data of each trajectory rod that was scanned, and then creating a line segment based on those trajectory rod data points.

Q. Did you -- the different-colored lines, can you describe what those are, please?

A. I'll try to remember the designations used by Oregon State Patrol because I adopted those. I believe this one -- I'm going to forget the side view mirror, but the purple line over here on the side is, of course, the one that strikes that mirror, and then fragments continue on into the side of the vehicle. We have the impact site, which I believe to be "U," in the grille right here. We have a bluish line, which goes with "T," which goes right into the hood here. And then up on top of the vehicle is the much talked about "W." And the green line emanating from that is the actual extension of the trajectory rod, and I left my measurements for that trajectory relative to the vehicle in view here.

Q. And what were the measurements that you obtained for the trajectory for impact "W"?

A. With the vehicle sitting flat and the top of the vehicle also flat, downward at 9 degrees, with an angle azimuth of 58 degrees, turning the view from the top, from the right of

the vehicle towards the left, from the rear of the vehicle towards the front, with a 58-degree angle between that trajectory and the side of the vehicle or a line running right down the middle of the vehicle, if you wish to look at it that way.

Q. And that angle of 58 degrees, what -- from the front of the truck, would that be 122 degrees?

A. That is correct. I can bring that measurement up as well, but of course those are simply supplementary angles, as I recall the proper term. 58 and whatever it takes to get to 180. 122.

Q. Can you describe how you measured the trajectory for impact "W" in this case?

A. Yes. I used the technique we've been talking about called the rocker point, which has also been termed other names. I simply used that term in order to help students remember that technique, and it is an example of when that technique is most effectively employed. When we have shallow-angle impacts to things like sheet metal, where the bullet is making contact at, again, a very shallow angle, and, because of the angle, encountering more and more metal in front of it than it would have if it had perforated at an orthogonal angle and leaving this lead-in mark going into the actual perforation.

Q. And by "orthogonal," do you mean straight in?

A. Orthogonal. A quick, easy definition is simply at

90 degrees to a plane. So perpendicular is a two-dimensional term; orthogonal is perpendicular or at a right angle to a plane.

Q. I'm showing you, for identification purposes, Government's DH19. What is this?

A. This is a view looking down on "W" with a trajectory rod laying through the long axis of the perforation itself.

Q. And did you take that picture as part of your investigation in this case?

A. I did.

Q. Is that photograph fair and accurate to the measurements and the tests that you conducted?

A. Well, my azimuth came from actually the data of the rod. This photograph would be an alternative way of measuring just azimuth. So just the left and right.

As you can see, it does not descend down into this nice, regular elliptical perforation. It's laying all the way across it. So that is a method of taking azimuth only.

Q. And have you aligned the trajectory rod to essentially bisect the hole?

A. That is correct.

MR. MALONEY: Offer DH19. Offer DH19, Your Honor.

THE COURT: Received.

BY MR. MALONEY: (Continuing)

Q. I'm showing you what has been marked for identification

purposes as DH20. Do you recognize that, sir?
A. I do.
Q. What is that?
A. This is the positioning of the trajectory rod in the rocker point. And, of course, working alone, you have to have a way of getting it to stay in place. So once I had worked with the trajectory rod, found the proper orientation with the end of the rod in the rocker point to establish vertical and viewing the trajectory rod right down the middle or long axis of the ellipse, I used assistive aids -- duct tape and a magnetic bracket -- to affix and hold the trajectory rod in place while I then went to my 3D laser scanner, hit the button to collect the data.

MR. MALONEY: Offer Government's DH20.

THE COURT: Received.

BY MR. MALONEY: (Continuing)
Q. Now, sir, did you bring materials to assist you in demonstrating the rocker point method?
A. I did.

MR. MALONEY: Your Honor, could the witness step down so that he can demonstrate that in a way that all parties and the Court can see?

THE COURT: Sure.

MR. MALONEY: May I approach, Your Honor?

THE COURT: You don't have to ask. Just go about

your work.

MR. MALONEY: Thank you, Judge.

BY MR. MALONEY: (Continuing)

Q. I'm showing you a box that has a piece of metal affixed to it, with what appear to be one, two, three -- four holes in this, as Government's Exhibit DH37.

Do you recognize that, sir?

A. I do.

Q. What is it?

A. This is a portion of sheet metal from some of my preliminary tests with .223 bullets through sheet metal to evaluate the reliability or demonstrate the reliability of the rocker method with sheet metal and .223s.

Q. Since you -- do you teach this method?

A. Regularly.

Q. And are you -- do you have the materials here to conduct one of your teaching sessions on the rocker point method?

A. I can absolutely give a demonstration of how this works with these materials.

Q. And I've handed you a little white rod with a yellow tip on it. Can you demonstrate and explain what you are doing and why you are doing it with this rocker point demonstration?

A. You bet.

We can pick any one of these perforations to examine. Like this one closest to me, to start. It has a nice long

lead-in mark.

So I should be very clear about the definitions first. If I say "pinch point," what we're really talking about is the painted metal portion. This is where, because the bullet is stable and the curvature of the bullet is just slipping along the top, it's pushing the metal down, but paint remains. So lead-in mark and pinch point can overlap. "Pinch point" simply refers to the paint. The "lead-in mark" is truly that. It's the deformation where the bullet is making contact at the beginning, as it's leading in.

For this technique, all you need is about the last centimeter or so, often about a thumb's width or even a finger width, of a trajectory rod. In this case and with "W," we've got more than that. We have plenty. We come in and simply press that portion of the rod into the lead-in mark, and here is where the rocker point comes into play. I'll simply rock this back and forth. You can almost hear where it drops into the lead-in mark, which is relatively flat.

I'm sure there's some curvature there, but to this rod, it settles right into that rocker point. When you come above it, only the tip of the rod is touching. And if you come below it, the tip of the rod is not touching. So it settles right in with just a nice little bit of pressure.

This establishes our, in this case, vertical angle, because our sheet metal is horizontal, and I just look over the

top, just like in the other picture we saw a minute ago, and make sure that the trajectory rod itself goes right down the center of the perforation for our azimuth. We settle that into place, evaluate, and when I'm typically not working alone, as Ms. Dickerson indicated, I just hold this and take a scan of this trajectory rod in place, and that's what I use.

Obviously, when I work alone, I've got to stabilize it with other means; hence the duct tape to keep this portion down and the bracket to hold the trajectory rod at this end. We can do this over and over and over, as long as we evaluate, as we do with every trajectory, how well it's stabilized and how it aligns with the long axis. We can use the rocker point/lead-in mark technique.

Q. Will that technique work for an orthogonal strike or bullet impact?

A. Absolutely not.

Q. Why?

A. Because there is no lead-in mark. When we have an orthographic strike, it takes most of the metal with it. There is no smearing, if you will, of the bullet as it's descending into a shallow-angle impact. It has to be shallow to have a lead-in mark.

Q. Okay. Now, if this is the roof of a vehicle and the vehicle is at an angle at the time that it struck, will that affect your point of origin analysis?

A. There are two components to that. I measured the trajectory relative to the vehicle. You can lock that in. And then, of course, if you roll, pitch, yaw the vehicle -- otherwise it absolutely affects where that back-extrapolation goes within the seat.

Q. So the box here with the metal attached to it has a government exhibit sticker in the lower left-hand corner. If that is the left rear corner of this vehicle -- assume this is one vehicle -- and the vehicle pitches, is there a large change in the azimuth of the trajectory rod?

A. In this setting, no. The pitch does not significantly affect the azimuth, because really what we're dealing with, if we focus only on the azimuth angle, is taking our three-dimensional world with a sky and the ground and collapsing it down.

The azimuth angle is what we typically refer to if we're creating a bird's-eye diagram. So even if there's a vertical component to that trajectory, when you're looking at a bird's-eye diagram, everything is flattened down to two dimensions. Doing this and pitching the box, just as you did, does not change the azimuth angle in that particular case.

Q. Now, if the azimuth or if the rod is in place and you're making your trajectory and the vehicle is rolling, does that appreciably -- now, I haven't secured it very well. Where is our duct tape? But if it rolls, does that appreciably change

the point of origin of the trajectory rod?
A. If you roll perpendicular to the rod, it starts to, as you continue, but it all depends on how much.
Q. And now if the -- if the vehicle is yawing, moving the front end, changing direction right to left or left to right of the vehicle, does that appreciably change the horizontal component of this trajectory rod when it's placed in the -- in place?
A. With that one, the vertical does not change; the horizontal does, absolutely.
Q. In this case, was there evidence of vehicle movement when the vehicle -- here the Finicum truck -- was in the snow?
A. I certainly have no firsthand knowledge of that, but that's my understanding of part of this case.
Q. And what direction is your understanding of the -- the potential movement of the truck?
A. As I recall, it started nose up and right side down and settled to a more flat angle; but, quite frankly, I don't recall. I'm focusing on trajectory versus vehicle in my work here.
Q. Was there any evidence that the vehicle yawed while it was -- from the time of the shooting to the time that it was recovered?
A. That would be slightly outside of my purview as far as what I examined in this case.

Q. Okay. But the important plane of consideration is the plane that the impact is on; correct?
A. Could you restate that?
Q. So -- I'll withdraw the question. That was --
Now, with this -- we'll keep this here. We may get back to it. Hang on. You can go ahead and go back to your seat.
A. Okay.
Q. When you are conducting forensic work in the field, are you working under ideal laboratory conditions?
A. Unlike a lot of laboratory work, crime scene work definitely goes outside that boundary. You are rarely working in ideal conditions.
Q. And would it be fair to say that you deal with the evidence that you have?
A. That's a fair statement.
Q. And do you try to adduce as much data and information from the evidence that is presented to you in the given crime scene?
A. You do.
Q. When you conducted your analysis in this case, what range of certainty did you use?
A. For "W," in particular, I still attribute plus or minus 5 degrees.
Q. Now, you were present in the courtroom when Ms. Dickerson testified about her method. She didn't use the rocker method. Can you compare and contrast her method versus your rocker

method for the Court?

A. The difference between the two, as far as result in this case, is that the vertical is going to be slightly different. In this case, I think she measured 20 degrees with the vehicle sitting level, relative to gravity, where I measured negative 9 degrees. So negative 20 versus negative 9 relative to the vehicle. The azimuths are almost exactly the same because of the fact that the rocker method aligns the rod more closely with the original path of the bullet prior to deflection after it gets into that metal and really starts to dig in.

The azimuths -- because our hole shape is elliptical, like this, the azimuths are virtually the same. They're two degrees different, as I recall.

So hers, with the cone, it slightly pushes it up. This is very common, quite frankly, for folks that have not encountered the rocker point/lead-in method before. The rocker point brings the rod down more closely aligned with the original path of the bullet.

Q. Now, getting back to Government's Exhibit 37, how did that piece of metal come to exist?

A. I shot that piece of metal back in November.

Q. And why did you shoot that piece of metal in November?

A. With the intent of potentially needing to demonstrate the rocker point method.

Q. Are there features on those bullet strikes that are common

to impact "W"?
A. There are.
Q. Can you explain those for the Court, please?
A. The first is the elliptical shape of the perforations, indicating that it is a shallow-angle impact. We have nice long lead-in marks, which are not unusual at all.

The only thing that these particular shots don't have is that slight pushed-up edge on the downrange side. I re-created that on other vehicles. I have seen that many times before. And it really just depends on exactly which angle you get when you strike the sheet metal.

You can take about five shots at about the same angle, and two or three may have that little lip; two or three may not have it. It really depends on how much the projectile either comes apart or bites into the metal.
Q. And did you conduct these empirical tests in order to replicate the circumstances that was under your current investigation with impact "W"?
A. I did.
Q. And describe what circumstances you were trying to replicate.
A. Angles of impact similar to or close to what we're dealing with to demonstrate these physical properties and to demonstrate the reliability of the rocker point method itself. So I used both light and heavy .223 caliber bullets. I even

used some .30 caliber rifle bullets and .308 in the past. In my shooting recon classes, I've used everything from 9 mm Luger handgun, .40 Smith & Wesson, .45 automatic, and a variety of others, as well as rifles, such as 30-06, .308, .223, and others. So a wide variety of parameters I've used in the past.

In this particular case, I focused on .223, but also .308, as an example that this is a broad spectrum technique.

Q. Did you bring examples of these empirical tests with you today?

A. I did.

Q. And are -- in preparation for your testimony, did we review those together, and are those all from Government Exhibit H?

A. I would have to know what Exhibit H is for sure to be able to say that.

Q. Do you have the test video from November 2017 on your computer?

A. I'll look for the file.

Q. "55 grain semi small slow."

A. Thank you.

Q. This is a fly-through.

Can you explain what we're looking at here, starting at the left side of the image?

A. Unlike the scan data of the vehicle, what we're looking at are called intensity map returns. The colors are sort of

rainbow like. They're simply a reflection of how much of the energy put out by the scanner is coming back. Instead of taking a photograph, which adds more time to the scan data and is unnecessary, that's why we have these colors.

What we're looking at over here on the left is actually me in position with a .223 -- actually, Wylde, but a .223 Remington-type rifle, an AOR, set on a tripod, where the gun would be fired over and over again. And off to the right is the rest with pieces of sheet metal. In fact, that one there, as well as others. And the blue lines are line segments created in the software by taking data from the muzzle of the gun while it's locked in and in position on the tripod and then going to the actual impact sites on the sheet metal.

So the blue lines in a linear model show where the bullets actually went from gun to impact. The red lines, these are some of the 55-grain bullets that I fired, which is on the lighter side, are the actual back-extrapolations of trajectories, just like I would do with evidence, just like I did with "W." And we can see, as we move in, in this fly-through -- again, this is a fixed set of the data -- that the difference between the known shots, the blue lines, and these three red lines, is 3 degrees, 4 degrees, and 5 degrees.

Q. Okay. Can you continue to play the video.

A. (Witness complies.)

We get a view moving around. You can see my hands holding

the trajectory rods on top, and we can look back and see how the azimuths compare as well.

Q. And --

MR. MALONEY: We offer Government Exhibit DH21, and that is from government's previously filed Exhibit H, Your Honor.

THE COURT: Received.

BY MR. MALONEY: (Continuing)

Q. Sir, were you trying to replicate low-angle impacts in these tests?

A. I was. And this is just one set of three with the 55-grain. I did a total of six shots of another type of ammunition, the heavier 64-grain Gold Dot, as well as the .308 in this particular day's work.

Q. And in Exhibit 37, is that -- are those also low-angle impacts?

A. They are.

Q. And were you specifically trying to strike these test sheet metals with low-angle impacts?

A. I was.

Q. From known angles?

A. I -- actually, we derived the angles from the measurements. I didn't set up the angle at anything in particular, other than about 10 degrees-ish relative to the sheet metal plane itself.

Q. And --
A. There are known angles -- I'm sorry. I should have added. In a way, they are known angle impacts because we have the firearm scanned in as well. If we didn't have that portion of it, then they wouldn't be considered knowns; but because we know where the gun was in that scan, that these are known angle impacts.
Q. Okay. And did you and I review other photographs from other tests that you conducted?
A. We did.
Q. I'm showing you what's been marked for identification purposes as Government's Exhibit DH22, and on the upper left-hand side of this image, what is depicted?
A. Lost it.
THE COURT: There you go.
THE WITNESS: Great. Thank you.
In this, the upper left area right here, that's the firearm position. We're at a top-down view in this particular case. Here is the test build and our measurements down below.
BY MR. MALONEY: (Continuing)
Q. And these angles are 4-degree, 3-degree, and 5-degree?
A. They are.
Q. Is that the same as the video we just saw?
A. I believe this is the same test set, yes. There's almost a "V" here and here, because I decided in the sequence to shoot

in two different directions to help illustrate the fact of how accurate this technique is. So if you lay all these trajectories on top of each other, you have a beautiful "V" of trajectories that go back to the gun.

Q. I'm showing you Government's Exhibit 23 of what is depicted here.

A. Trying to clear this. Sorry, guys.

There we go.

This appears to be the side view of two 55-grain shots. I know that because of the red color. On the other sequence, this is the other side of the "V," and, indeed, these are 3 and 5 degrees difference between the trajectory's treated like-evidence versus the blue lines, which are the knowns.

Q. I'm showing you Government's 24.

A. I see it. Yep.

Q. What is depicted here, sir?

A. This is another type of ammunition. Again, trying to go for a spectrum of some weights. These are three shots with 64-grain Gold Dot, and, in this particular case, the variation we have from the known angles to the measured evidence like angles is basically zero. Went right back to the gun for 1, 4 degrees and down at 2 degrees.

Q. And were these also low-angle impact shots?

A. They are. Absolutely.

Q. Government's 25, sir, what is depicted here?

A. This is the other portion of my "V." These are three additional shots with 64-grain Gold Dot and our variation from known to un -- to evidence-type trajectories. It's 3, 1 degree and 3 degrees.

Q. And, again, this one was also low-angle impacts?

A. It is.

Q. Government's 26. What is depicted here?

A. These are the three .308 caliber shots that I fired. Again, from the same position. You can see the firearm off to the left. Again, to open up the spectrum and indicate or demonstrate, as I've seen many times in the past, this is not caliber-dependent. And we can see that the green reconstructed or back-extrapolated lines, compared to our blue known lines, and in this case 4 degrees, 2 degrees, and 3 degrees.

Q. These were all low-angle impacts as well?

A. They were.

Q. And in all of these, Government's Exhibit DH22 through DH26, were all of these measured using the rocker method that you described and demonstrated in court today?

A. In combination with 3D laser scanning, yes.

MR. MALONEY: We'd offer Government's 22 through 26.

THE COURT: They're received.

BY MR. MALONEY: (Continuing)

Q. Sir, did you bring with you a copy of a video that you -- of scan data from April of 2018?

A. I did.
Q. Was this another empirical test that you conducted?
A. It was.
Q. Can you display that, and we'll -- for our purposes, we'll call that Exhibit DH27.

THE COURT: Before you go on to that, you said it was not caliber dependent, so it -- whether it was a .22 or a .38 or a .45, or what have you, it wouldn't make any difference?

THE WITNESS: That's correct. As long as we have shallow-angle impact where that side of the bullet is when it's fasted and first striking, coming into contact with the sheet metal, to create that lead-in mark. As long as it comes in shallow enough to create a lead-in mark, yes.

My only caveat to that would potentially be -- and this is where I would actually go out and do empirical testing. If I was dealing with a plain lead bullet. You mentioned .38 Special. Because it's so much softer, typically, on the sides, I would probably go and do some testing to ensure that it was reproducing.

THE COURT: Thank you.

BY MR. MALONEY: (Continuing)
Q. Can you show us the video from April 14, 2018, of the scan data that you conducted?
A. Yes.
Q. Can you describe to us what we're looking at here?

A. When I understood, again, after reports were circulated, that there was some discussion or question about the rocker point, I decided to actually go and shoot a vehicle with more .223 ammunition, in particular, as a demonstration that it doesn't matter whether this sheet metal is, say, on a box or on a vehicle, and to indicate the reliability of it. So I had access to a red car that was available for shooting. I did the same procedure. You can see my firearm over here on the left.

THE COURT: What did you use?

THE WITNESS: For a firearm, sir? In this particular case, I used a -- the lower is a Rock River Arms. Lower. The upper is a PWS short-barreled rifle or papered SBR. It's actually chambered in .223 Wylde. In this particular case, the rifling is one in nine, as I recall.

BY MR. MALONEY: (Continuing)

Q. What was the angle of impact that you were approximately trying to replicate?

A. I started off by trying to replicate the general size and shape and characteristics of "W" and trying to re-create our raised lip on the downrange side, which I did, and then doing the same process again and back-extrapolating to where the gun was as if it were an unknown -- or if it were evidence, and we can see my angles.

It's important to note that for this test, as well as when I was working with the sheet metal on cardboard, I was not

looking back at the gun trying to align the trajectory rod with the gun. In fact, the gun wasn't even there anymore. And I was looking down, focusing on the trajectory rod, holding it in place. At this point, I had help to actually hit the button on the scanner to start collecting data. So this was me looking at the rod, not where it was pointed.

Q. Okay. And you're displaying right now the scan data from that test?

A. I am.

Q. Did you bring with you a copy of the video?

THE COURT: Are you speaking into the mic?

BY MR. MALONEY: (Continuing)

Q. Did you --

MR. MALONEY: I must not be, Your Honor.

THE COURT: All right.

BY MR. MALONEY: (Continuing)

Q. Did you bring with you a copy of the video of the fly-through that you created from this test?

A. I had forgotten if we had a fly-through for this particular one. I know we had a fly-through for the other. Yes. Here it is. Thank you.

MR. MALONEY: For the record, Your Honor, that's from Government's Exhibit H that is -- has been filed.

THE COURT: Thank you.

///

BY MR. MALONEY: (Continuing)
Q. Were all those measurements that were displayed here conducted using the rocker method?
A. They were.
Q. Are they all within 5 degrees?
A. They are.
MR. MALONEY: Offer Government's -- offer this video, Your Honor, as DH27. Previously filed under Government's Exhibit H.
THE COURT: Received.
BY MR. MALONEY: (Continuing)
Q. Sir, did you also take photographs of this incident --
A. I did.
Q. -- or this test?
A. I did.
Q. I'm showing you what's been marked for identification purposes as Government Exhibit DH28. Can you describe what is depicted here?
A. These are some of the shots into the red vehicle that I just showed scan data of.
Q. Fair and accurate?
A. It is.
MR. MALONEY: Offer Government's DH28.
THE COURT: Received.
///

BY MR. MALONEY: (Continuing)

Q. Sir, I'm showing you what's been marked for identification purposes as Government Exhibit DH29. What is depicted in this image?

A. An additional set of shots from the trunk of that vehicle. They may have been in that other picture, as well. But these are closer-in pictures of it.

Q. Are there any features that are depicted in this image that are common to government -- or to impact "W"?

A. They are still shallow-angle impacts, and these are all approximately the same angle. But you can see how that raised lip is present on this one, the beginnings of it on this one, and just a little bit of it on that one.

Q. Were these low-angle impacts into sheet metal, are these features common in your experience?

A. The lead-in marks, the elliptical shape, presence or lack of the raised lip on the downrange side, none of these are surprising to me.

Q. I'm showing you what has been marked for identification purposes as Government's Exhibit DH30. What is depicted here?

A. Another two shots on that vehicle, as I recall; although, I can't tell if that's just zooming in to give some scale, but they're shots into the red vehicle as well.

Q. And are these -- were these taken during this test?

A. They were.

Q. And is the image depicted here fair and accurate to the conditions of those impacts after you shot that car?
A. They are.
Q. And any of these features common -- or what features, if any, are shared between these impacts and impact "W"?
A. Many of the same characteristics: lead-in, elliptical shape, varying degrees of raised lip on the downrange side.
MR. MALONEY: Offer Government's 30.
THE COURT: Received.
BY MR. MALONEY: (Continuing)
Q. Showing you what's been marked for identification purposes as Government's Exhibit DH31, what is depicted in this photograph, sir?
A. Could potentially be some of the same shots we've been looking at, but I lowered the camera angle a little bit so that you could see the raised lip on the downrange side a little bit more.
Q. Does this also share that elliptical shape?
A. It does.
Q. Can you point out to the Court where the lead-in mark would -- is on the hole depicted here in DH31?
A. Yep. The lead-in mark is here, and the raised lip is here.
Q. And can you demonstrate for the Court where, in your experience, you would place a trajectory rod measuring this

with the rocker point method?
A. As I did with the scans right through the long axis of that lead-in mark.
MR. MALONEY: Offer Government's DH31.
THE COURT: Received.
BY MR. MALONEY: (Continuing)
Q. Showing you what's been marked for identification purposes as Government's Exhibit DH32, sir, do you recognize what's depicted in this photograph?
A. I do.
Q. What is it?
A. Another one of my shots onto the red vehicle.
Q. And is that fair and accurate to the condition of the shot after you made that shot?
A. It is.
Q. And are there features in this impact that are -- that are shared with impact "W"?
A. Yes. This one has an even longer lead-in mark. We can see it start right here. Continue on into the perforation. We even have some bending up of the metal on the downrange side. Elliptical shape.
MR. MALONEY: Offer Government's DH32.
THE COURT: Received.
BY MR. MALONEY: (Continuing)
Q. Showing you, finally, sir -- I think this is probably --

is this a photograph of the scan data that we've seen both from your scan data and the video that was presented earlier in the previous exhibit?

A. Yes. This appears to be a still shot of the shots fired into the red car.

Q. So all those shots that you measured that day into the red car, were they all using the rocker point method?

A. They were.

Q. And what was the range of difference between the known angle and the measured angle using the rocker point method pursuant to your scan data?

A. For these five demonstrative shots, 3 degrees, 3 degrees, 3 degrees, 4 degrees, 4 degrees.

Q. All within plus or minus 5?

A. They're within 5 degrees -- less than 5 degrees from the known trajectory.

MR. MALONEY: Offer Government's DH33.

THE COURT: Received.

MR. MALONEY: Your Honor, I think -- my co-counsel has told me that I missed one of those in my exuberance to demonstrate that evidence. I overlooked offering DH29.

I offer DH29 at this time.

THE COURT: Received. Does that conclude your direct?

MR. MALONEY: Oh, I have a little bit more to go,

Your Honor.

THE COURT: How much is a little?

MR. MALONEY: I have 20 more minutes, Your Honor.

THE COURT: We'll take a recess for ten minutes.

(Recess taken.)

THE COURT: Where is our witness?

THE WITNESS: Right here, sir.

THE COURT: Okay. Do I daresay, "Fire away"?

BY MR. MALONEY: (Continuing)

Q. In these emperical tests, the ones you conducted in November and again in April -- or correction -- November 2017 and April of this year, were there any of those tests that measured more than 5 degrees outside of the known angle of impact?

A. Of those tests? No. 5 was the greatest separation between the known trajectory versus the measured evidence-like trajectory.

Q. In response to the challenges to your work in this case, did you reach out to other scientists to find out if there were high-speed videos available of bullet impacts into sheet metal at low angles like this case?

A. I did.

Q. And did you hear from -- hear back from anyone?

A. I did. I heard back from some colleagues who I had worked with at the German Bundeskriminalamt.

Q. And did they --

THE COURT REPORTER: I'm sorry. Could you --

THE WITNESS: B-U-N-D-E-S-K-R-I-M-I-N-A-L-A-M-T. The BKA.

BY MR. MALONEY: (Continuing)

Q. And did they provide you with high-speed video of bullets impacting sheet metal at low angles?

A. They did. I believe I sent them a picture of one of my tests on the red vehicle or potentially the silver sheet metal and said I was interested in looking at the bullet's impact that created elliptical shallow-angle impacts similar to that one.

Q. Did you bring one of those videos with you today?

A. I did.

Q. And is that the German test video labeled "201804171020_v13_mpg.mp4"?

A. This is one of them. I have it on my Desktop, yes.

MR. MALONEY: For Counsel, that was previously discovered in Bates No. 88198.

And it's been -- for today's purposes, Your Honor, we will be referring to that as Exhibit DH34.

THE COURT: Thank you.

BY MR. MALONEY: (Continuing)

Q. Can you show that video, please.

A. I can. It should loop.

Q. Can you describe what we are looking at in this video.
A. It's sort of an over-the-shoulder view of the bullet approaching sheet metal at a shallow angle. We can see the impacts. We can see the raised lip on the downrange side. I have still shots in a moment that will show the nice long lead-in mark. We can see fragments, a few coming up over the top. The majority of the bullet going down through the sheet metal in what's likely to be lead vapor.

Also depositing on the downrange side, a phenomenon called lead splash. But it's a nice way of seeing and understanding what's really happening when the projectile strikes sheet metal.

Q. And is this helpful in understanding why the rocker point -- or why you believe the rocker point is a reliable method for measuring low-angle impacts into sheet metal?
A. It is.
Q. Can you explain why?
A. It gives us the visual representation that the bullet is beginning to lose metal, that changes are occurring to it as it progresses down the impact site. But we can see, when it first makes contact with that sheet metal, the side of the bullet is leaving here. That straight little area right here; however, you'll see it better in the still shot here in just a second.
Q. And did you bring a copy -- or did you bring images from this video that are a closeup of the impact site?

A. I did.
Q. And can you show one of those images?
MR. MALONEY: And, Your Honor, for the purposes of this proceeding, we'll refer to this photograph at DH35.
THE COURT: Very well.
MR. MALONEY: The second one that he's showing now as DH36.
BY MR. MALONEY: (Continuing)
Q. Sir, looking at --
THE COURT: You're offering them?
MR. MALONEY: Yes, Your Honor.
THE COURT: They're received.
MR. MALONEY: I'll offer all three.
THE COURT: They'll be marked "received." Go ahead.
MR. MALONEY: That's DH34 through -36.
BY MR. MALONEY: (Continuing)
Q. In DH35, sir, that's the one with the tape measure and 193 next to it. Can you describe what we're looking at in this image and compare and contrast it to impact "W"?
A. It's very similar to "W." We have a nice long lead-in mark. In fact, this picture begins to cut off a little of where the bullet first begins to make contact at the bottom of this image. I think I've got it. Yeah. That is the full image as sent to me. It's a fairly low-resolution image. We can see a nice long pinch point leading into it. The remaining

paint on this side or down in the lead-in mark, elliptical perforation, and beveling upwards on the downrange side.

Q. Turning to DH36.

A. Same impact site, just slightly rotated to see it longer. I should mention that this is -- from their work, they measure the known angle. It's right around 10 degrees or so. I can go into the document to find out what that actual impact angle is, but it's right in that 10-degree zone.

Q. Okay. And does that also have the raised edge at the downrange side of the impact?

A. It does. On this picture, it's to the right.

Q. And is the -- is there anything you -- common between the shape of these impacts and impact "W"?

A. I would say this is very similar to impact "W."

Q. And in your work, sir, are these typical or atypical impacts for low-angle impacts into sheet metal?

A. Realizing that we use the terms "typical" and "atypical" to indicate stability, which is also most often reflected as symmetry, this is a regular impact.

Q. Okay. Going back to the video, when you say "stability," what are you referring to? And is that demonstrated in this video?

A. With this particular shot, because it's over the shoulder, it is not as easy to see as with some of the other videos where actually they -- I wouldn't say inadvertently, but they were

using a lower spin rate barrel with heavier .223 bullets, and they were launching bullets that were unstable, so they were tumbling. It doesn't look like that. So this is an example because they used a Steyr AUG with a tighter rifling twist than their PROOF barrels. This bullet is indeed stable. It's going nose first; hence the very regular parabolic symmetrical lead-in mark, compared to other videos where the bullets are unstable, we can see, using the term we just talked about, irregularity in those shots.

This shows the bullet is nice and stable.

Q. Sir, have you had a chance to review Mr. Bray's critique of your 2008 study?

A. I have.

Q. And do you have any responses to the critiques he raises in that study and the statistical validity of your 2008 study?

A. I do. My responses would be I agree with many of his criticisms of the paper, actually.

Q. And in what -- in what way do you agree?

A. In 2008, in that time frame, that's when statistics in, say, uncertainty of measurement were first coming into the purview of crime labs, in my opinion, having lived through that time. And I think some of the things, right off the bat, that he described was the use of the standard deviation and averaging it across different population sizes, and I -- having reviewed it now, which I hadn't looked at that paper in a long

time, I would agree with that. I think there are better ways to handle that data than the way I did.

Q. Would those -- would handling that data differently affect your opinion about the appropriateness of plus or minus 5 degrees as a standard range of certainty in typical ballistics measurements?

A. No. The plus or minus 5 degrees as -- if we want to use the term "industry standard," actually does predate the 2008 paper. I have a citation from a very well-regarded shooting incident reconstructionist where he talks about it. It is, I think, primarily based on practical empirical testing is where that comes from.

The data that I forwarded in that paper seemed also to support plus or minus 5 degrees, and the nice thing is is that because the raw data was published in that article, we could actually go back to that data and indeed treat it from a more statistical standpoint and see what it leads to.

However, in the absence of that, the plus or minus 5 degrees, having been around before, from emperical knowledge, and as specifically demonstrated with the rocker point here, is a level of uncertainty that I do have confidence in based on emperical testing.

Q. Is one of those studies Mattijssen and Kerkoff's May 2016 article in *Forensic Science International*?

A. That's a more recent article which specifically deals with

a variety of techniques, including what they call the lead-in technique, but yes.

Q. And are you familiar with the Huske or Hueske *Practical Analysis and Reconstruction of Shooting Incidents*?

A. I am.

Q. Does Mr. Hueske describe --

THE COURT: Spell that.

MR. MALONEY: H-u-e-s-k-e.

THE COURT: Thank you.

BY MR. MALONEY: (Continuing)

Q. Does he describe --

THE COURT: Is she all right?

MS. FERGUSON: Oh, yes. I'm just getting a book.

THE COURT: Okay.

BY MR. MALONEY: (Continuing)

Q. Does he describe a thing called "the shoulder" in reference to bullet impacts?

A. He does.

Q. And what is he referring to when he refers to the shoulder?

A. It's a little bit unclear. I agree with the manner in which Ms. Dickerson described it. I can't tell whether he's saying to use just the tip of the trajectory rod or not; but what he is basically saying is, again, whether the rod is fully into the impact or not, you want to press that against what he

calls the shoulder and I believe to be the lead-in mark.

MR. MALONEY: And that is found at page 120, Counsel, in Hueske's Second Edition *Practical Analysis and Reconstruction of Shooting Incidents*.

BY MR. MALONEY: (Continuing)

Q. He talks about a shoulder being present?

A. He does.

Q. Referring back to Government Exhibit 36, which is the impact from V13 -- well, that one there -- can you point for the Court in that exhibit where the shoulder is?

A. Again, in my opinion, what Mr. Hueske is talking about is, indeed, the lead-in mark. This area right here. Because he's talking about deflection going into the metal and pressing against the shoulder, in my opinion, he's saying press the rod against the lead-in mark. Whether the end of the rod is deeper into it or not, I don't know.

Q. In his book, he describes centering rods -- or if holes are large and/or irregular, centering the rods will give the best trajectory estimate. This may be accomplished by using centering cones, physically holding them, or using two strips of tape in a hole in an X pattern to create a support for the rod at the center of the hole.

He also talks about pressing the rod against the shoulder. And in this book at page 120. What do you interpret that to mean?

A. As stated, pressing the trajectory rod into the lead-in mark is how I interpret that.

Q. Can you demonstrate that with Government's Exhibit 37.

THE COURT: Go ahead.

THE WITNESS: If he is talking about the rod not penetrating the hole, then we're talking about basically the rocker point. If we're talking about being in the hole, it's still very close to the rocker point; although, I wouldn't say it's resting as securely as the rocker point.

BY MR. MALONEY: (Continuing)

Q. And he actually talks about using tape. How would you use the tape as he describes, or how would you position the tape?

A. In shooting incident reconstruction and crime scene investigation, it's not always easy, clean. You don't always have the tools with you that one might prefer. And so what I understand him to be talking about is something I've done in the past, too, when you need to, to help stabilize and position something like a trajectory rod. It sounds like he's talking about taking a couple pieces of tape, as an X, and having the rod rest in the X in order to stabilize it.

Q. So show -- can you show us with 37 where those pieces of tape would be if you're using Hueske's shoulder method?

A. My interpretation of that is more of a vertical plane, so I can't really demonstrate that here. My understanding of what you just read would be where the tape is in a vertical plane

and the rod resting on it in that manner.

Q. Okay.

THE COURT: While you're there, I'm more interested in whether your feel that you talk about is subjective or not. Show me how you do -- how you develop your feel.

THE WITNESS: You bet. There is absolutely subjectivity in everything that a human being does; however, when you feel this, pressing right here, you can almost hear it.

THE COURT: Yeah.

THE WITNESS: And it very nicely stabilizes. So, in my opinion, if you practice it a few times, such as at a class where you actually do the shooting or observe it, you get a very nice feel, if you will, for how to establish it. And that applies whether we're doing rocker or whether we're going through a more orthographic stripe.

THE COURT: Can it depend upon who is doing the feeling?

THE WITNESS: Absolutely. And their training.

THE COURT: Thank you.

BY MR. MALONEY: (Continuing)

Q. Mr. Haag, in -- you train --

THE COURT: Let him get back on the stand.

Oh, you have more?

MR. MALONEY: We have a couple more here, Judge.

THE COURT: That's fine.

BY MR. MALONEY: (Continuing)

Q. Mr. Haag, when you conduct these trainings, is it a hands-on endeavor to demonstrate proper use of the rocker method?

A. It is.

Q. Would it be helpful to you to show either the Court or Counsel, in your role as a teacher, how to accurately perform the rocker test to eliminate this subject -- subjectivity concerns?

A. It wouldn't be much different than what I presented before. It's actually feeling how solid that trajectory rod drops down into that lead-in mark and then looking right down the central axis and making sure that you're not far off.

So any subjectivity in this method is no different than subjectivity in others. Some perforations fit more tightly, such as "T," having examined that shot into the hood. It's a nice, beautiful, well-established trajectory rod. When using the rocker method, I'm very confident that this is just as accurate as "T," quite frankly.

If we had a situation where we didn't have a stable bullet, then we must back off and say there's insufficient physical evidence to make a conclusion. So there's always, whether it's forensic science or any other kind of science, a determination or judgment that we have enough physical

evidence.

With a nice stable bullet like this, this is very reliable.

MR. MALONEY: Would the Court or Counsel want to take a -- a try placing the rod using the rocker method as you've demonstrated?

THE COURT: Do what you want.

MR. MALONEY: I'm -- I'm offering an invitation, Your Honor.

THE COURT: If they want to do that, they can do that in cross-examination.

Retake the stand.

MR. MALONEY: Okay. Thank you, sir.

BY MR. MALONEY: (Continuing)

Q. You talked just now about subjectivity in rod placement. Is that common in low-angled -- is that unique to low-angle impacts, that there is subjectivity in rod placement?

A. It is not.

Q. Is it common in two-point analyses? Rod placement using two points?

A. There is subjectivity in that as well. I can see that in the data, the raw data that I've collected from these classes, even when you have, say, a two-point trajectory, one like "T," you can still get degrees of variation from one person measuring it to the next. Every measurement ever taken in a

human endeavor is an approximation. It's just a question of how much variation comes around that.

Q. And you believe you have established to a reasonable degree of scientific certainty or ballistics certainty that the rocker method is reliable to plus or minus 5 degrees?

A. Well, understanding that reasonable degree of ballistic certainty is not a forensic term, it's a legal term, my understanding of what you're asking me is is it reliable, is it based on science, and is it based on physical properties, tangible things that are reproducible. Absolutely.

Q. Would you agree or disagree with this statement, sir, that Ms. Dickerson's measurement is inconsistent with your measurement of impact "W"?

A. I believe, based on the techniques employed, they're measuring two different things.

Q. Can you explain that statement, please?

A. I think every report I've read, in my opinion, also agrees that particularly because of the shallow nature of impacts like these and how much metal is in front of the bullet because of that shallow angle, we quickly get deflection of one kind or another, and, in many cases, fragmentation. Some of the metal can come up above and some below.

So by going to the secondary impacts inside, you're really tracking more of the fragmented deflected bullet. So its path after it's traveled through, such as this example of V13, more

of the metal where the rocker point is tracking the very beginning of the bullet's interaction with the metal and is therefore more a representation of the trajectory prior to impacting the sheet metal.

Q. Are you aware of any studies beyond your own empirical studies that you've talked about today that use the rocker or lead-in method to ascertain a reliable range of certainty?

A. Yes. There's a very nice one by Wim Kerkoff, whom I know, as well as Erwin Mattijssen.

Q. And can you describe for the Court what that study says?

A. They used some handgun bullets and three different methods. They used a point-to-point method. An ellipse method, where you're drawing -- again, subjective -- over the top of an ellipse, comparing the long axis versus the short axis of the ellipse. It's similar to bloodstain pattern analysis. And they use what they call the lead-in mark, where they're pressing the rod, and, in their terms, some millimeters, against the lead-in.

Q. And did they use -- did they measure impacts to sheet metal at different angles using what they term the lead-in method?

A. They did.

Q. And what were their results?

A. There is a very nice chart in the report that shows that at the very shallow angles, and as I recall starting around

8 degrees, going up through the teens, into the 20s and 30s, in shallow-angle impacts like this, they show what I believe to be their error bars, their range of measurements for multiple different people who came through and measured them, to be very, very small. And as it gets steeper, that range of measurements got ridiculously large because the shoulder went away. Because the lead-in mark no longer existed because the angle had become orthogonal. It demonstrates what we had been talking about for a while.

Q. And, finally, sir, based on your work in this case, your training and experience in the field of ballistics and shooting incident reconstruction, did you form an opinion to a reasonable degree of ballistic certainty as to the trajectory for the bullet that caused impact "W"?

A. Again, given the caveat I said before with regard to that term, yes.

Q. And what is that opinion?

A. That the values that I described prior for impact "W" are the best measurements for the trajectory relative to the vehicle and could then be back-extrapolated into a scene for firearm location.

Q. And the range of certainty with those measurements?

A. I believe plus or minus 5 degrees is a valid range for that type of impact and back-extrapolation.

MR. MALONEY: Thank you, sir.

Those are all my questions, Your Honor.

THE COURT: Okay.

CROSS-EXAMINATION

BY MS. FERGUSON:

Q. Good morning, Mr. Haag.

A. Good morning.

MS. FERGUSON: Now I'm on the mic; right?

THE COURT: Yes.

MS. FERGUSON: Okay.

BY MS. FERGUSON: (Continuing)

Q. You are a co-author, Mr. Haag, of a book called *Shooting Incident Reconstruction*; is that correct?

A. I am.

Q. And you dedicate an entire chapter of that book to discussing projectile ricochet and deflection; correct?

A. Correct.

Q. And your book defines deflection generally as a deviation in a projectile's normal path through the atmosphere as a consequence of an impact with some object.

A. I think there's always room for improvement, because, technically, deflection can occur just going through the air because of the pull of gravity; but, yes, I agree with that definition.

Q. And this definition of deflection can be further refined

for deflection as a consequence of perforation; correct?

A. You'll have to define "further refined."

Q. Well, let's take a look in the binder that you were just handed at Tab 24.

Do you recognize the document behind that tab?

A. I do.

Q. And what is that document?

A. That's the cover of the Second Edition of *Shooting Incident Reconstruction*.

Q. And can you turn three pages past the table of contents to what is marked at the bottom of the .pdf as 7 of 83?

A. I'm with you.

Q. Okay. And is that chapiter 9 of your book?

A. It is.

Q. And is that chapter entitled "Projectile Ricochet and Deflection"?

A. It is.

Q. Okay. And let's take a look at page 145 of your book. It's page 9 of the .pdf?

A. I'm with you.

Q. And do you see at the top of that page where it states that deflection as a consequence of perforating, penetrating, or striking an object describes deviations in any direction from the projectile's normal flight path as a consequence of perforating or striking an object rather than rebounding off

its surfaces?
A. I do.
Q. And this is a more refined definition for deflection as a consequence of perforation; correct?
A. It certainly has more detail to it than the first one.
Q. Now, a bullet may be deflected by passage through sheet metal; correct?
A. Certainly.
Q. And such deflection can occur in any direction?
A. Yes. But depending on the angle of impact, that deflection may be more predominant in one direction or another.
Q. And depending on the direction of the twist of the gun, that could also play a role in deflection; correct?
A. From practical experience, it depends greatly on the material that's being struck.
Q. Can you turn to page 149 of your book. The .pdf page is 13.
A. I'm with you.
Q. Can you go to the bottom of that page.
A. Uh-huh.
Q. And does the first sentence of the bottom of that page state, "Lateral or side deflection, as a consequence of ricochet from a homogenous material, depends largely on the direction of twist of the gun that fired the bullet"?
A. Yes, it does.

Q. Okay. And in addition to the direction of the twist of the gun, yaw can also play a role in deflection; correct?
A. I would have to know -- are you talking about the bullet being unstable prior to arrival yaw or some other type of yaw? Yaw is simply a change in the projectile's longitudinal axis from where it was. Typically, when we talk about yaw, we mean it's off of its actual path.
Q. I'm talking about yaw in the most general sense that yaw can play a role in deflection.
A. I have a hard time answering that question because it certainly can depending on whether we're dealing with a stable or unstable bullet. Of course, that's going to be more or less.
Q. Can you turn to page 169 in Chapter 9 of your book? That's page 33 of the .pdf.
A. Page 33. I'm with you.
Q. Okay. And I'm looking at the fourth full paragraph from the top of the page. Are you there?
A. I'm with you.
Q. And do you see where it says, "Bullet yaw at impact also appears to play a role in direction of deflection and influences the magnitude of any deflection in thick objects"?
A. Absolutely.
Q. And you would agree that yaw is greatest in the initial portion of the flight before the bullet becomes fully

spin-stabilized; correct?

A. It's certainly oscillating before what is typically referred to as the bullet going to sleep. So the example it's talking about here with *Hatcher's Notebook* is an illustration of that, yes, that within a certain distance of the muzzle, the nose of the bullet is processing slightly after certain distance, depending on the gun and ammunition. The bullet tends to actually become more stable.

And if it is more stable than going into things, like, in *Hatcher's Notebook*, trees, what we would see is, after the initial penetration, a more stable bullet from further range would actually go deeper.

The ones that are still not asleep yet, the nose is more easily deflected after it begins to get into the oak tree and we begin to see yaw. Absolutely.

Q. And it takes approximately 200 yards for a bullet to go to sleep and become spin-stabilized; correct?

A. It depends on the projectile, the weight, the twist of the barrel. I don't believe there's one set distance for that.

Q. Okay. Can you turn in the same document that you're on now to page 71 of the .pdf?

A. I'm with you.

Q. And that is page 407 of the glossary of your book; correct?

A. Correct.

Q. And do you see in the glossary where the term "yaw" is defined?
A. Yes.
Q. And you see where it states that some yaw is almost always present when a bullet is fired, but this usually dampens out within 200 yards if the bullet is properly stabilized and well balanced?
A. I do.
Q. Now, turning back to Chapter 9 in your book, which starts at page 7 of the .pdf, this chapter does not contain the term "rocker point"; correct?
A. That's correct.
Q. And it does not contain the term "sweet spot"; correct?
A. That's correct.
Q. And can you turn to the -- back to the glossary that we were looking at previously in your book, which starts on page 51 of the .pdf?
A. I'm with you.
Q. And nowhere in this glossary does the term "rocker point" appear?
A. That's correct.
Q. And the table of contents of your book does not contain the term "rocker point"?
A. That's correct.
Q. And it doesn't contain the term "lead-in method"; correct?

A. That's correct.
Q. Now, on November 17, 2017, you conducted your own exam of Mr. Finicum's truck; correct?
A. I did.
Q. And you estimated several different bullet paths in connection with this exam?
A. I did.
Q. And can you turn to Tab 1 in your binder? Do you recognize the document at Tab 1?
A. It appears to be a page of my notes with my horrible handwriting.
Q. And these are your notes on the hood shot to Mr. Finicum's truck; correct?
A. Correct.
Q. And you note that impact "T" is located on the hood of the Dodge Ram truck?
A. Correct. The front right area of the hood, as I recall.
Q. And that bullet perforated the sheet metal of the hood; correct?
A. Correct.
Q. And it also perforated the fibrous liner?
A. Correct.
Q. It also perforated a hose inside the engine?
A. It did.
Q. And bullet fragments also struck multiple parts, hard

metal portions of the engine closer to the firewall; correct?
A. I believe I found actually quite a few areas which visually were consistent with lead and vapors lead, these fast bullets, when the cores hit hard objects, such as pieces of an engine, almost create a cloud of lead. We saw that in the video from the German Bundeskriminalamt, and I saw that on the right side of the engine block further along that trajectory.
Q. And you used a trajectory rod to estimate the flight path of the bullet that caused impact "T"; correct?
A. I did.
Q. And in your notes, you noted that this rod was well-seated in the metal perforation; correct?
A. I did, correct.
Q. And you also noted that the rod was inserted through the hose perforation?
A. Yes. It was a very nice fit.
Q. So this rod was held in place by not one, but two different perforations; correct?
A. I'm trying to remember how tight the trajectory rod was in the perforation through the metal in the hood itself. Certainly the hose being elastic material made a nice tight grab on the trajectory rod, yes.
Q. In your notes, you stated that the rod was well-seated in the metal perforation; correct?
A. Correct.

Q. There was no need to use a centering cone in connection with your measurement of impact "T"?
A. Correct.
Q. And there was no need to use a stabilization device of any kind?
A. Correct.
Q. Can you turn to Tabs 2 and 3. Take a look at Tabs 2 and 3 in your binder.
Now, these are photographs of impact "T"; correct?
A. They certainly appear to be, yes.
Q. And you observed symmetry in this hole; correct?
A. I do.
Q. And you observed the metal pushed inward at both ends of this defect?
A. Correct.
Q. And can you turn to Tabs 4, 5, and 6, or just take a look at those? And are those photographs of the exit side of impact "T"?
A. They appear to be, yes.
Q. And the -- the metal is pushed in the photograph behind Tab 6. You can actually see the metal being pushed inward?
A. Correct.
Q. Can you turn to Tab 7 and 8 of the binder? Are those photographs of the hose that was perforated?
A. They are.

Q. And there's an entry side to that perforation and an exit side behind Tab 8; correct?
A. Yes.
Q. Can you turn to Tabs 10 and 11 of your binder.
A. I'm with you.
Q. And is that -- are those pictures of your placement of a white trajectory rod into that defect to measure the flight path of that bullet?
A. Oh, I'm sorry. I'm still on 9. 10? Yes. 10 appears to have one of my trajectory rods going into "T" in the hood, and 11 is similar, just a different angle or view.
Q. And that rod is fixed between two points; correct?
A. In a way, it's tough to say just two points. I think there was discussion about three earlier; but, yes, there's certainly multiple inline impact sites and perforations that lead to that description of it being well-seated.
Q. So you're correct. There actually are three perforations. There's a perforation in the metal, there's a perforation in the fibrous liner, and a perforation in the hose; correct?
A. And additional subsequent impacts, correct.
Q. Can you turn to Tab 12, please. Do you recognize the document in Tab 12?
A. I do.
Q. How do you recognize it?
A. Mostly, again, my handwriting.

Q. And are these your notes on the roof impact to Mr. Finicum's truck?
A. Yes.
Q. And you highlight several different features of impact "W" in these notes?
A. It certainly has bullet points, yes.
Q. You note that it's a shallow-angle impact?
A. Which bullet point are you starting with?
Q. I'm on number three, where you write "shallow-angle impact."
A. Which tab? I'm sorry.
Q. Tab 12.
A. My third bullet point or dash says, "Sweet spot/rocker point best for trajectory assessment due to shallow angle of impact. Good about one-plus centimeter of area for this."
Q. Okay. So you use the words "shallow-angle impact" in that bullet. That's all I was trying to establish.
A. Yeah. Sorry. I didn't see you were that deep into the sentence. Yes.
Q. You described that impact or -- or you described what you call a great pinch point?
A. Correct.
Q. And you describe a bending of metal?
A. I'm looking for the actual words "bending of metal," but certainly there's bending of the metal.

Q. It's in the second bullet point. I'm sorry. I'm jumping around.

And your notes also make reference, as you noted, to a sweet spot; correct?

A. Correct.

Q. And you describe the rocker point as a one-centimeter area?

A. Technically, I say "tilde one-plus centimeter."

Q. And how much of that centimeter constitutes the sweet spot?

A. The sweet spot is that point where the rod bottoms out and lays nice and flat in that lead-in mark. So it's the lead-in mark.

Q. And the rocker point is directly over the pinch point in this case?

A. Bear in mind that pinch point, again, refers specifically to paint and its relationship with sheet metal when it's shot; but that, yes, the lead-in mark and the pinch point can overlay. Pinch point does not have to be a spot.

In fact, I was talking to my dad about this the other day, asking if he coined that term, and that was his recollection is that he coined "pinch point." But it doesn't have to be a point. It is that area where paint remains where the bullet first made contact with painted sheet metal. The lead-in mark can overlay that.

Q. Now, your book defines the lead-in mark as a dark elliptical transfer of material; correct?
A. That has a slightly different meaning in yielding materials where you are actually getting bullet wipe transferring over in that same shallow-angle entry side, yes.
Q. So is your lead-in mark a form of bullet wipe, or is it a bending of metal?
A. There could be two different contacts. The point is it is the beginning of the bullet's interaction with the surface leading into a perforation or a scooped-out area of a ricochet. So it's first contact leading in; hence lead-in mark.
Q. So, in this case, you're using a different definition of "lead-in mark" than you use in your book?
A. I think, as stated, they're certainly related; but seeing or hearing your definition that you read from the book with regard to the bullet wipe portion, yes, they are related but not the exact same definition. Correct.
Q. Now, your notes also indicate that you examined the inside of the truck; correct?
A. Correct.
Q. And you looked closely at the headliner on the inside of the truck; correct?
A. I wouldn't say that I spent a ton of time on the headliner, particularly because I knew the interest was back-calculation not where the fragments went, and the

headliner had already been moved, had been examined, so it was not, say, the first time through it; but I certainly looked at it.

Q. Let's turn to Tab 16. Is that a photograph of you placing a trajectory rod over top of impact "W"?

A. That appears to be my hand, yes.

Q. And did you scan that placement of that rod?

A. No.

Q. So the trajectory measurement that you reported was not based on the placement of that rod in that manner?

A. That's correct. This photograph was an azimuth-only demonstration in case I wanted that later. I actually got the measurements from the rod in place, fully in place.

Q. And what is the diameter of that rod?

A. This, I believe, to be the exact same rod that I have here in court today. This one is the .30 caliber-type rods. The yellow ones. You can see some of the remaining paint on the left side are nominally .30 caliber; the pink ones are nominally .22 caliber.

Q. And can you translate that to a millimeter measurement?

A. .30 caliber would be about 7.6 millimeters, if you will, or .30 inches, if you want to stick with inches. In the .22, about .22 inches or is that one nine, one eight millimeters, point -- around in there.

Q. I'm sorry. That was a lot of numbers. But I want to make

sure you believe it's close to 7 millimeters.
A. Honestly, I'd want to do the math. I was trying to convert metric calibers to imperial calibers, but there's not a lot of metric conversion from .22. Oh, yeah. 5.56. What am I thinking? So about 5 and a half millimeters for a .22 caliber rod.
Q. Okay. And that rod is fully covering the pinch point in this photograph; correct?
A. In this photograph, the .30 caliber rod is covering almost the entirety of the impact site itself.
Q. And can you turn to Tab -- look at -- take a look at Tab 17 and 18.
A. I'm with you.
Q. And these photographs show your trajectory rod after it was taped and clamped; correct?
A. They do.
Q. And this is what you scanned; correct?
A. That's correct.
Q. So this is the rod that determined both the vertical and the azimuth angles that you estimated in this case; correct?
A. That's correct.
Q. Now, in order to place this rod, you placed the 1 centimeter yellow tip of your trajectory rod into the rocker point, correct?
A. I wouldn't say I would limit it to the 1 centimeter. It's

the end of the rod going along with however much of that flat spot it will bottom out in. In my notes, if you recall, again, it was tilde 1 centimeter plus.

Q. And after you placed that rod, you felt for that rod to settle into the sweet spot?

A. Correct.

Q. And the sweet spot is part of the rocker point?

A. I wish I had chosen a term and stuck with it. The whole reason why we have sweet spot/rocker point/lead-in is because it was an evolution of the use of the term. I had to figure out something over time once I learned of the technique that a student would remember. So one class I might have said "sweet spot," another class I might have said "rocker point," and "lead-in mark," same thing.

Q. So after you felt for that sweet spot or lead-in mark or rocker point, you had to secure that rod in that sweet spot; correct?

A. Correct.

Q. So you taped that rod into place?

A. I did.

Q. And you also supported the rod with a clamp?

A. Yes. It's a magnet on one side, which, of course, on steel vehicles it's a big strong magnet and a very rigid arm with a screw-down clamp on it.

Q. And you can't rule out the possibility that that rod

shifted during the taping process; correct?
A. No. I would disagree with that because, before I pulled it back off, I examined it specifically for that purpose. Because that's, of course, a concern.
Q. So you can say with 100 percent certainty that that rod did not move by a millimeter during that taping process?
A. That's correct. Between the duct tape and the clamp, I believe that's a very firm affixment of the rod.
Q. And why did you need both the tape and the clamp?
A. The clamp would have allowed too much movement on the downrange side towards the impact. You needed something to keep downward pressure, meaning the tape at the lead-in mark.
Q. And did you apply the tape first or the clamp first?
A. Honestly, I don't have a recollection.
Q. So you don't have a standard process for -- for how you support a rod in this position?
A. Down to that fine detail? Absolutely not. Crime scene shooting incident reconstruction placement of rods takes a thinking person to establish it, affix it. There's no one way that you can say will always work for something like that.
Q. So you don't teach your students a standard method for stabilizing a rod in the rocker point position?
A. The standard method is stabilize the rod in the rocker point, the sweet spot, the lead-in mark, and align it with the long axis of the impact.

Q. You were first contacted by the government about this case in September of 2017; correct?
A. Honestly, I don't remember the exact dates of when I would have been contacted. I know I was giving a class up in Washington when we first met in person up in that area.
Q. So you did meet with an agent and an attorney in person; correct?
A. I did.
Q. And they gave you an overview of the January 16, 2016, [sic] shooting incident?
A. That's a fair statement.
Q. And you were shown audio and video files taken during that incident?
A. Yes.
Q. And you were also shown photographs taken after that incident?
A. Yes.
Q. You were shown a trajectory analysis by Victoria Dickerson; correct?
A. I believe so.
Q. And you were shown diagrams created by a Deschutes County patrol deputy by the name of Kevin Turpen; correct?
A. I believe so.
Q. And you informed the government that you could not validate Ms. Dickerson's findings or Mr. Turpen's findings

without conducting your own examination?
A. I would agree with that statement.
Q. And the rocker point method is the only method you know of that would have been appropriate to use to determine the pre-impact path of the bullet that caused impact "W"?
A. In my opinion, that is the best choice for that purpose, yes.
Q. And shallow shots fired through sheet metal where significant deflection has occurred, trajectory rods give the most accurate representation of firearm location when the lead-in portion of the defect is used as opposed to secondary impacts or the entirety of the impact site?
A. I believe that's a fair statement from the book, as I recall.
Q. And you first learned about the rocker point method in 2002; correct?
A. No. When I was reviewing for this case and trying to -- to backtrack how I came to know this method, I think the first range I gave was 2002 to 2006, because those were the years when I taught this class at Gunsite -- a shooting facility in Arizona -- and I knew that one of the students from San Diego County was the person who I recalled, to the best of my recollection, while we were working on shallow-angle impacts to the side of the car, him saying, "Hey, watch this." And so he demonstrated the rocker point method, and later I found out

that he was most likely in the class in 2004.
Q. So the rocker point method wasn't demonstrated to you until 2004?
A. That's my best estimate.
Q. Okay. And you started using the rocker point method consistently in 2006?
A. No. I would say soon after that.
Q. Okay. When did you start teaching the rocker point method in your courses?
A. You could consider that the beginning. Because as soon as he demonstrated it, we could see that it went back to the known firearm location much more accurately than going into the trajectory or into the perforation itself. That class would be the beginning, if it, indeed, was 2004.
Q. But you don't know one way or the other whether you were teaching the rocker point method in your classes in 2004?
A. Again, I don't know for sure that that was the year, but it was a Gunsite class. I remember that much.
Q. Do you maintain a syllabus for the courses you teach?
A. I've had several syllabuses over the years. I don't know if I have ones that go back to the time frames we're talking about at Gunsite. I think the Gunsite classes did have printed handout manuals, so you could consider that a syllabus.
As of now, I absolutely do have syllabuses for more current years.

Q. And when you went back to your records in this case to determine when you first learned of the rocker point method and when you first started teaching of it, you couldn't identify any mention of the rocker point method in those handout materials in 2004; correct?

A. That's correct.

Q. And you couldn't identify any mention of the rocker point method in those handout materials in 2005; correct?

A. Again, I don't think I actually looked through those documents because I wouldn't have -- I wouldn't expect myself to have made a notation like that at that time.

The rocker point is such a small portion of the class and, quite frankly, in my mind, a minor technique, that, no, I wouldn't expect myself to have made note of that.

And even in the current syllabuses, I don't think it's mentioned as a culled-out topic, to the best of my recollection.

Q. Is your *Shooting Re -- Shooting Incident Reconstruction* book required reading for your courses?

A. Required reading? No. It is basically the handout because much of the course relates to what is in the book. It is required reading for the National Firearms Examiner Academy that is run by the ATF when I teach that class every year.

Q. I believe you testified to this just now, but I want to make sure the record is clear. The handout materials that you

maintain for your courses now do not make mention of the rocker point method; correct?

A. To the best of my recollection, no.

Q. And going back to your first meeting with the agent and attorney in this case, when you looked at the photos of Ms. Dickerson's trajectory analysis of impact "W," you saw that she did not use the rocker point method; correct?

A. I did.

Q. And you and Ms. Dickerson estimated a different flight path for impact "W,"; correct?

A. It appears we were representing two different things, correct.

Q. Now, going back to your book, in addition to the chapter on deflection, you've also dedicated an entire chapter to the shooting of motor vehicles; correct?

A. That's correct.

Q. And in that chapter you warn that with vehicles it's dangerous to assume that the distance between entrance and exit holes represents a straight line.

A. Do you have that in the materials so I can see the context?

Q. Sure. We can go back to Tab 24, which is your book, and Chapter 15. I have to find the .pdf page. It begins at page 39 of the .pdf. And then within Chapter 15, you can go to .pdf page 45.

A. I'm with you. I'm sorry. If you can read the sentence I should clue in on again.

Q. Sure. So I'm actually looking at Figure 15.3, and I'm looking at the first sentence of A, and this warns about the danger of assuming that the distance between entrance and exit holes represents a straight line; correct?

A. Correct.

Q. And on the top of the next page you also explain that two points do not necessarily represent a straight line and at some point the examiner needs to look inside complicated vehicle structure.

A. This section in this area relating specifically to car doors, absolutely. You should -- you should check what things have been set along the path in order to assess the deflection.

Q. And to your knowledge, has -- have the layers between the roof perforation to the sheet metal and the hole in the headliner, has that area ever been fully explored?

A. I probably need a better definition of "fully explored." That's a difficult situation to be in because, in order to see in there, you have to alter the surface. So maybe if you can define that a little bit better.

Q. Well, you note in your book on page 273 that, quote, "We prefer the viewing window approach to trajectory reconstruction and bullet recovery"; correct?

A. Correct.

Q. And can you explain the viewing window approach?
A. Yeah. This is specifically when you have an item, such as a car door, with some decent thickness to it. So the viewing window concept wouldn't apply to where you got sheet metal -- let me do it this way: Sheet metal, insulation, headliner all packed together because they're all right there. This is specifically talking about when you have a bullet -- let's say -- let's do it this way: Here's the outside of the car door. The bullet approaches and strikes. And as the diagrams indicate, if you have the interior -- let's say it's an outside-to-inside shot. If you have the interior of the car door here and an exit, you can't and should not just assume that it went from point A entry to the B entry into the cab of the vehicle without cutting a viewing window or in some other way making sure that it didn't hit a big large structure inside the door.

And car doors are notorious for this because of things like roller mechanisms, structures that are strengthening structures, things like that.

So the viewing window would be for thicker materials, like doors offset from the actual perforation. So you can do just that. You can see in there, preferably without altering the location of the perforations.

Q. And is it your testimony that the viewing window approach could not have been used for impact "W" in this case?

A. I would not have used the viewing window technique because those layers are all close together. You wouldn't really see anything. You could have potentially cut the actual perforation, removed a layer, cut and removed a layer, but I don't know what you would necessarily gain out of that.

Q. Could you have measured how thick those layers are?

A. Sure.

Q. Now, you also note in this chapter that one of the most common errors that examiners make when they track a bullet's path through a vehicle is to assume that the bullet passed directly from the primary entrance to the visible exit; correct?

A. And that's what I just described. Yep.

Q. And that's a problem because it does not account for the potential deflection that was caused by the first impact; correct?

A. No. The purpose in this chapter is, again, to be talking about other structures inside of a door where a bullet enters the door. You can't just assume where it enters the vehicle's cab is one straight line without it hitting something else inside first. That's what that refers to.

Q. Okay. Putting aside this chapter, with impact "W," you can't assume that the bullet's flight path stayed the same from the muzzle of the gun to the impact to the rocker point and out the hole in the headliner; correct?

A. Based on past empirical testing with shallow-angle impacts like this and particularly fast light bullets like .223s, I would expect deflection once it got into the sheet metal and continued on, if that's answering your question. I believe it is. I would expect deflection further on down the track. Absolutely.

Q. Your report describes your use of a standard uncertainty range of plus or minus 5 degrees; correct?

A. It does.

Q. And you applied that uncertainty range to all of the flight paths that you estimated in this case; correct?

A. No. I don't think I applied it to the side view mirror, but certainly for "T" in the hood, "U" in the grille, and for "W," yes.

Q. And focusing in on impact "T" and impact "W," which we've already looked at, you used two different methods to estimate those two flight paths; correct?

A. They're two very different trajectories and impact sites, so absolutely.

Q. But you applied the same cone of uncertainty; correct?

A. That's correct.

Q. Now, you authored a study in 2008 entitled "The Accuracy and Precision of Trajectory Measurements"?

A. I did.

Q. And that study was published in the *Association of Firearm*

and Tool Mark Examiners Journal?

A. Yes, it was.

Q. That's the first scientific study to statistically establish the plus-or-minus-5-degree uncertainty cone you used in this case; correct?

A. As described earlier, it's the first one I know that actually threw the data out there and -- and looked at it from the numerical standpoint, as opposed to solely empirical testing over a broad scope of types of shooting incidents, calibers, guns -- excuse me. I choked -- calibers, guns, and impact surfaces.

Q. And based on your statistical analysis in that study, you concluded that plus or minus 5 degrees is appropriate for the majority of trajectory examinations; correct?

A. With the given caveats that I stated earlier about the paper.

Q. You also note in the paper that a larger cone may be appropriate in some situations; correct?

A. Actually, I say larger or smaller, depending on the material struck.

Q. A larger cone may be appropriate for shallow-angle impacts, for example?

A. Very well could be.

Q. And a larger cone may also be required for perforations of heavier metals with an increased likelihood of deflection?

A. Correct.
Q. Now, you based your 2008 study, as you've already mentioned today, on measurements that were taken by students in your shooting reconstruction courses; correct?
A. This is correct.
Q. And a question that often came up in those courses was what is the accuracy and precision of bullet path measurement?
A. Yes.
Q. And from your work in the area, you had a general feel for the accuracy and precision of various different trajectory methods; right?
A. I would agree with that statement based on actual empirical shooting and testing, yes.
Q. But you recognized that good scientifically defensible methods require an in-depth statistical analysis?
A. I don't think I would say that necessarily.

For example, in this case, that's one of the reasons why I did testing with similar types of ammunition, similar materials, to look at the actual knowns versus unknowns, in addition to the demonstrative part of it. So while, yes, quite frankly, I plan on going back to this data, working to see if a statistical model is appropriate or not, it's not the only way to get there.

Q. Can you turn to Tab 23 in your binder? And is this document your 2008 study?

A. It is.
Q. And I want to draw your attention to the left column of the first page, and I'm looking at the bottom paragraph.
A. Uh-huh.
Q. And that paragraph states one of the main thrusts of these shooting reconstruction classes is to address the following question: "What is the accuracy and precision of trajectory or bullet path measurement?" Correct?
A. Absolutely. Correct.
Q. The next sentence says, "From practical work in this area, the author" --
Who is you; right?
A. Correct.
Q. -- "had an emperical educated answer to this question, but good scientifically defensible methods often require an in-depth statistic analysis."
A. I agree.
Q. Did I read that correctly?
A. You did.
Q. Now, between 2002 and 2007, you compiled data from 12 different courses you taught; correct?
A. I'll have to count them briefly, but I'll take your word for it. The list is on the next page.
Q. Now, two of those classes were taught in 2002; correct?
A. Correct.

Q. And I believe you testified just a few moments ago that you did not learn of the rocker point method until 2004; correct?
A. That's my best estimate, yes.
Q. And do you know whether you learned about the rocker point method in the NFEA class or the Gunsite class that's listed on the table on page 146 of your 2008 article?
A. Yeah. As stated, the most likely one is going to be Gunsite '04.
Q. But you don't know for sure whether it's Gunsite '04 or any of the other classes listed on this page?
A. No. My recollection is it was a Gunsite course. It was a long time ago. But, again, my best estimate is Gunsite '04.
Q. And these classes examined several types of practical exercises in order to address the level of accuracy and precision of short-range trajectory measurement; correct?
A. That's correct.
Q. And you define accuracy as how close a measured quantity is to true value?
A. Correct.
Q. And you define precision as how reproducible measurements are?
A. Correct.
Q. I want to focus your attention on the accuracy tests which begin on page 148 in the study in the right-hand column.

A. I'm with you.
Q. Now, you created known vertical angles for your -- for your accuracy test by shooting downward through a vehicle roof; correct?
A. That was the most common method of creating vertical-only knowns; correct.
Q. You created the azimuth-known angles by firing into the side of a vehicle?
A. There were probably shallow-angle ricochets on the hood that had known azimuths as well; but, by far, yes, I agree with your statement.
Q. And you marked the locations of these shots on the ground with spray paint; correct?
A. Most commonly, spray paint. It could have also been a marker or a tint.
Q. Okay. If you turn to page 150 in the study, and we can focus on the photograph at the top of that page, do you see the picture that has Xs with numbers --
A. I do.
Q. -- written next to them on the ground?
A. I do.
Q. And those Xs show the locations of the known angle shots; correct?
A. That's correct.
Q. And so when the students were making their measurements

they could visually crosscheck the alignment of their trajectory rods with the known location of the firearm; correct?

A. Absolutely. The main point of it is for them to, once establishing the rod, be able to look up range to see whether they're getting the right result. Correct.

Q. Now, each of these known angle shots was measured by several students; correct?

A. Correct.

Q. In some cases, 14 different people measured the shot?

A. It varied, but yes.

Q. In some cases, only two or three people measured the shot?

A. Correct.

Q. And you did not observe each group's data collection; correct?

A. That's correct.

Q. And you don't know which methods were being used to measure which shots; correct?

A. That's correct. All I can say is that as time proceeded away from 2014, there were certainly measurements in there where I had demonstrated and shown people how to use the rocker point, particularly for the shallow-angle shots into the side of car doors.

Again, it doesn't matter whether the sheet metal is horizontal or whether it's vertical, like the side of a car,

it's the same technique.

So I absolutely agree with you. I can't tell you exactly which measurements go with which technique.

Q. And you weren't teaching the rocker point method in the classes in 2002; correct?

A. I agree. That's likely, anyway.

Q. Now, overall, you collected approximately 450 data points that you used in your -- in your accuracy tests?

A. For that period of time, yes.

Q. And those data points are contained in Appendix B to this study which starts on page 162 of the study?

A. Correct.

Q. And those data tables don't say anything about which methods were used to measure which shots?

A. That's correct. This study was meant to be a broad scope examination of trajectories, not one method.

Q. Well, when you say "this study was meant to be" -- in 2002, when you started collecting this data in these classes, did you have this study in mind?

A. No. It actually was a joint formed -- you know, the data was there, and I continued to collect it later on for the purpose of building up a stockpile of data points. So I would say the first point was to have the data from each class to show the students to give them an idea of what was going on.

THE COURT: What is your projection for close?

MS. FERGUSON: I probably have another 15 minutes.

THE COURT: All right. Go ahead.

MS. FERGUSON: Would you like to take a break?

THE COURT: I'm fine. I'm just trying to accommodate your request to do -- get your thing out of the way or completed.

MS. FERGUSON: I'll try to speed it up.

THE COURT: I think your partner is talking to you.

MS. FERGUSON: We'll take a short break and see if I can consolidate. We can take a lunch break.

THE COURT: Well, we -- we're -- we have flight problems with our witnesses.

MS. FERGUSON: Right.

THE COURT: What is your schedule, sir?

THE WITNESS: To make the flight, sir, I believe I have to be out of here by 3:00. Leaving here, at the latest, by 3:00.

THE COURT: I can't hear you unless you speak into the mic.

THE WITNESS: Sorry, sir. At the latest, based on my projections, a 3:00 departure from here would be the absolute latest that I would need to be done.

THE COURT: We'll keep going. You just wrap it up.

MS. FERGUSON: Okay.

///

BY MS. FERGUSON: (Continuing)

Q. Now, in your -- in your data tables, some cells are marked with an X; is that right?

A. That's correct.

Q. In some cases, students either failed to provide a measurement --

A. Correct.

Q. -- or in some cases -- in other cases, some students were more than 15 degrees away from their peers; right?

A. That's correct.

Q. So you just eliminated those outliers from statistical calculations; correct?

A. Absolutely. Keeping with what I had learned in college with regard to some statistical work.

Q. And your study discusses several statistical concepts; right?

A. I believe it does.

Q. And one of the concepts is absolute value difference?

A. It is.

Q. And one of the concepts is standard deviation?

A. It is.

Q. And one of the concepts is normal distribution?

A. Correct.

Q. And you're not a statistician; correct?

A. By profession, I am not.

Q. And there's no mention of the rocker point method in the entire 2008 study?

A. I'll have to double-check one of the spots to see whether it's here or not.

No. That's incorrect. Again, it's one of those defining things. But if you look at page 149 from the *AFTE Journal*, your number -- well, it's the area below me with --

THE COURT: Just read it.

THE WITNESS: Yes, sir. "Note the classic pinch point for shot number 19," blah, blah, blah --

THE COURT REPORTER: Could you read it a little slower?

THE WITNESS: You bet. "Additionally, for shallower shots fired through sheet metal where significant deflection has occurred, trajectory rods give the most accurate representation of firearm location when the lead-in portion of the defect is used as opposed to secondary impacts or the entirety of the impact site."

BY MS. FERGUSON: (Continuing)

Q. And what you just read doesn't describe how to use the rocker point method; correct?

A. Not in detail, as far as if I were instructing someone, no.

Q. Okay. Can you turn to Tab 25 in your binder?

Is this a copy of the Mattijssen and Kerkoff study from

2016 that you testified about on direct?
A. It is.
Q. And this study only measured vertical angles; correct?
A. That is my recollection.
Q. And it only measured nine vertical angles?
A. Honestly, I don't remember the exact number, but I -- I don't have an argument to that.
Q. The article warns that the sheet metal used in their experiments deformed to a greater degree than what they see in typical vehicle metal impacts; correct?
A. Can you refer me to that location?
Q. That's on page 210 of the article, which is page 7 of the .pdf. I'm looking at the left-hand column and the third paragraph in that section.
THE COURT: Look at your screen.
THE WITNESS: Yes, sir.
BY MS. FERGUSON: (Continuing)
Q. That reads: When applying the results from the shots in the sheet metal in practice, careful consideration of the data should be taken into account. Although the sheet metal was bent to try and replicate some of the tension in the sheet metal in car doors, it is not completely sure whether this was sufficient. The deformation of the sheet metal plates due to the impact of the bullets seem to be greater than usually seen in hit car doors. This additional deformation might have had

an unknown effect on the performance when applying the lead-in method when compared to applying the method on car doors.

A. I see that, yes.

Q. And you measured some test shots with the rocker point method before you signed your report in this case?

A. I did.

Q. And you measured some test shots with the rocker point method after you signed your report in this case?

A. I did.

Q. And for both of those tests, you were the person who took the shots?

A. Yes.

Q. And you were the person who measured the shots?

A. Correct.

Q. And for one test sample -- for one of the tests, your sample size was 14?

A. Of .223s, I think you have to add three -- no. You're correct. You're correct.

Q. And for the second test, your sample size was five?

A. Correct.

Q. And you didn't make any absolute value difference calculation for either of these tests; correct?

A. No. The angles that I showed would be the absolute value difference between the known trajectory and the back-extrapolated trajectory. So it's neither positive nor

negative. It's just the furthest angle apart between the two.
Q. And you didn't calculate any standard deviation in connection with those absolute value differences?
A. I did not.
Q. And you didn't calculate any normal distribution in connection with those differences?
A. Nope.

MS. FERGUSON: That's all I have.

THE COURT: Thank you. Anything further?

MR. MALONEY: Just a quick redirect, Your Honor.

THE COURT: Fine.

REDIRECT EXAMINATION

BY MR. MALONEY:
Q. You were testifying about the Mattijssen article -- and I believe it was page 210 of that article -- on the lead-in method and the article warning about deformation when they tried to replicate the bent metal of a car door.
A. Yes.
Q. Did you -- your first test from November used plain sheet metal; correct?
A. Correct.
Q. What did you use on your second test?
A. An actual vehicle.
Q. Why did you use an actual vehicle for that second

emperical test?
A. I was going to need a lot more surface area to get a lot of shots fired into the vehicle and to demonstrate that exact point, that it doesn't matter whether you have a flat independent piece of sheet metal or a vehicle.
Q. And you were measuring on that vehicle the angle of impact in order to back-extrapolate the trajectory or point of origin for that bullet path; correct?
A. Correct.
Q. You were not measuring the angle of deflection after the bullet penetrated, were you?
A. Absolutely correct.
Q. And is that because that was not the important inquiry to validate your measurements on shot "W"?
A. That's correct.
Q. You were asked about doing any statistical analysis for these empirical shots. Did you document the measurements?
A. Absolutely.
Q. And are they subject to reproduction?
A. They are. The data, in fact, is right here and provided in discovery.
Q. And all of those empirical measurements were within 5 degrees of the known trajectory?
A. The majority were in the 2- and 3-degree distance. The largest was 5.

THE COURT: And that's repetitious to what I heard before. Anything further?

MR. MALONEY: No, Your Honor. Thank you.

THE COURT: All right. Now, you go get on your airplane.

THE WITNESS: Thank you, sir.

THE COURT: Let me hear from anybody as to our next witness. Who is that going to be?

MS. FERGUSON: Dr. Bray, Your Honor, for the defense.

THE COURT: And what is his time frame? He is he here?

MS. FERGUSON: I believe he's here. Yes. He's in the back of the courtroom. I believe he has the afternoon.

THE COURT: Dr. Bray? Okay. You're available for the afternoon; is that right? Go.

DR. BRAY: Yes, I am.

THE COURT: Okay. Thank you. Let's pick up at -- what -- our time frame would be 1:30. Is that satisfactory?

MS. FERGUSON: Very good, Your Honor.

MR. SUSSMAN: That's fine, Your Honor. Thank you.

THE COURT: Dr. Bray, be ready, front and center, at 1:30.

Thank you. Court is in recess.

(Lunch recess taken.)

MR. MALONEY: Good afternoon, Judge Jones. Mr. Haag

informed me on the break that I had neglected two topic areas.

THE COURT: Just a moment. What are you saying?

MR. MALONEY: Your Honor, with the Court's permission we would like to re-call Mr. Haag for two brief topic areas.

THE COURT: That are they?

MR. MALONEY: They are areas relevant to our inquiry here with acceptance in the community and some scientific validation -- additional scientific authorities for plus or minus 5 degrees.

THE COURT: For heaven's sakes. I've worked us all clear the lunch hour so we could clear this witness. Now you come up with two more questions. Where is he?

MR. HAAG: Right here, sir.

THE COURT: Come back on the stand.

REDIRECT EXAMINATION

(Continued)

BY MR. MALONEY:

Q. Mr. Haag, as part of your work in this case, did you reach out to other agencies to inquire about whether they used the rocker method?

A. I did.

Q. And were these agencies that you had contact with through your work as an instructor?

A. They were. The individuals that I had contacted, yes.

Q. And were they currently using the rocker method?
A. That was the question I posed to them, and the ones I talked to respond, yes, they use this technique.
Q. And who responded?
A. The organizations that -- that the people worked for were Toronto Police Department in Canada, Washington State Patrol, San Diego Police Department, Sacramento County DA's Crime Lab, Salt Lake City Police Department, Utah State, the Texas Rangers, Mesa Police Department, Johnson County Kansas, Arizona DPS, Boston --

THE COURT REPORTER: I'm sorry. Could you slow down, please.

THE COURT: You can't possibly do that.

THE WITNESS: Boston Police Department, Los Angeles Police Department, Contra Costa County. I might have said that twice. No, I didn't. New Mexico State Crime Scene Team. Philadelphia Police Department. Montana State Crime Lab. West Valley Police Department, Utah. Phoenix Police Department. Minnesota Bureau of Criminal Apprehension. Richland County Sheriff's Office, South Carolina. And then a couple of independent experts. Currently, Coleman and Northcutt.

And this is not meant to be any sort of all-inclusive list. These were just people I contacted and received responses back from in about a week, at the most, week and a half.

BY MR. MALONEY: (Continuing)

Q. You mentioned on the break that there was an additional source that validated your use of plus or minus 5 degrees and that it was an absolutely blind study. Can you tell the Court about that?

A. I had remembered that there was a presentation by Chris Coleman, who is well-known in the AFTE community, a presentation in 2013 at our Association of Firearm and Tool Mark Examiners meeting, where he used a similar protocol where he had mock walls that were fired upon at known angles, but it was completely blind. So he did that prior to the students examining the walls and taking measurements, and he also advocated plus or minus 5 degrees in that presentation.

Q. And has that presentation been peer-reviewed or published?

A. No. I keep prodding him to get the data out there and published, but it's just a presentation at this time.

Q. You use the acronym AFTE. Can you spell that out, what it means?

A. The Association of Firearm and Tool Mark Examiners.

MR. MALONEY: Thank you, sir.

Those are all my questions, Your Honor.

THE COURT: Goodbye.

THE WITNESS: Thank you, sir.

THE COURT: Next witness.

MS. FERGUSON: The defense calls Dr. Andrew Bray.

DEPUTY COURTROOM CLERK: Could you raise your right hand, please.

DR. ANDREW BRAY,

called as a witness in behalf of the Defense, being first duly sworn, is examined and testified as follows:

THE WITNESS: I do.

DEPUTY COURTROOM CLERK: Thank you. Would you sit down now, speak directly into the microphone, and spell your first and last name for the record.

THE WITNESS: Andrew, A-n-d-r-e-w. Bray, B-r-a-y.

THE COURT: I have Dr. Bray's CV. He is well qualified to render an opinion on statistics. We can go right to the essence, please.

MS. FERGUSON: Yes, Your Honor.

DIRECT EXAMINATION

BY MS. FERGUSON:

Q. Dr. Bray, you were asked to review the statistical methodology of a 2008 study entitled, "The Accuracy and Precision of Trajectory Methods"; correct?

A. Correct.

Q. And that study was authored by Michael Haag?

A. Yes.

Q. And that study was published in the *Association of Firearm*

and Tool Mark Examiners Journal; correct?

A. Correct.

Q. And to summarize your conclusions and your opinions on the statistical methodology of that study, you wrote a declaration; correct?

A. Correct.

Q. And you finished that declaration late last night?

A. Correct.

Q. Now I want to walk through the opinions in your declaration.

THE COURT: First of all, I want to have the declaration admitted into evidence because it's got the square root and other matters that can't be described adequately.

So go ahead.

MS. FERGUSON: Yes, Your Honor, we move to admit that declaration into evidence.

THE COURT: It will be received.

But, anyway, we want to hear live now as to his presentation. Go ahead.

BY MS. FERGUSON: (Continuing)

Q. Dr. Bray, you formed an opinion in that declaration regarding several different study design flaws in the 2008 study; right?

A. Correct.

Q. And can you please identify those flaws generally at a

high level?
A. At a high level, the three main flaws that I identified was the lack of blinding of the student evaluators; the second was that conditions were not held constant across the entire data set to assess the uncertainty; and the third was the improper treatment of the outlier data points.
Q. And in addition to those three study design flaws, you also formed an opinion regarding two kinds of statistical or computational errors in the 2008 study; correct?
A. Correct.
Q. And can you please identify those two different computational errors at a high level?
A. Yeah. Those two errors are the misuse of the standard deviation and the unjustified use of the Gaussian distribution in forming the cone of probability.
THE COURT REPORTER: I'm sorry. The what distribution?
THE WITNESS: Gaussian, G-a-u-s-s-i-a-n, which I might refer to throughout as the bell curve or the normal distribution. They're synonymous names for the same thing.
BY MS. FERGUSON: (Continuing)
Q. Okay. Thank you.
I want to go a little bit deeper into the three different design flaws that you just identified.
Can you -- can you start by describing the blinding

problem with the 2008 study?

A. Sure. So blinding can generally take two forms. Either of the subjects of some experimental intervention or of the evaluators of that intervention. In this case, there were -- there was no blinding of the student evaluators. That was described in the study that additionally students could visually crosscheck the trajectory rod with a known location. And this caused -- this opens it up to the possibility of something called evaluator bias.

Q. Okay. And can you talk more about the consequence of this blinding problem and this evaluator bias?

A. Sure. Evaluator bias would exist in a situation where you have human subjects that are asked to render a measurement but, in this case, they have knowledge of the truth. And if there's an expectation that knowledge of that extra information will guide their recording of the measurement, then that will incur some bias.

So in this case, I think it's reasonable to expect that students, if they see an X on the -- on the ground after they measure their rod, they would be favorably inclined to maybe round towards the true value. And the effect of this would be showing less dispersion than actually exists.

Q. And can you now describe the "mixed methods" problem or the "conditions not held constant" problem that you identified in the 2008 study?

A. Yeah. So in order to form this cone of probability, we need to have a good estimate of the chance error, and it's standard that if you want to evaluate the chance error -- this is the standard deviation -- you need to hold all other factors constant, control for all other sources of variability.

And the study identifies several sources of variability. I think paramount is the multiple methods that are used: the two-point, the centering cone, the rocker point method. But there's also use of the use of student evaluators versus ballistic professionals, how they might differ, whether or not the angle is shallow, the density and type of material that's being perforated, and there's mention of the stability of the incoming bullet.

And, essentially, the -- the paper states that you would expect, under different scenarios, to have different amounts of either sometimes wider or sometimes narrower uncertainty. And that suggests to me that you should be estimating multiple standard deviations, and for each one controlling those, each of those factors, to hold them constant, so you can get a stable estimate of that standard deviation. That wasn't done.

Instead, the -- essentially, all the data was just aggregated across these -- these different experimental conditions, multiple methods, multiple angles, multiple densities.

Q. And can you describe at a high level the consequence of

aggregating the data in this way across mixed methods?

A. Yeah. So one consequence is that if -- if, in fact, you concede that each specific scenario should have a different standard deviation associated with it and yet you're pooling everything to come up with your estimate of your standard deviation, almost by your own definition, that should be a poor estimate for any specific scenario.

The second is that the -- kind of the balance of these different methods, say, in the final data set, the two-point versus the rocker point, if they're, indeed, behaving differently and you're averaging over them, their relative influence on your final estimate is purely driven by which one you happen to collect more data of.

In this case, it's unclear even how to address that because it wasn't recorded which method was used for each of the observations.

Q. And now can you talk about the third one of the study design flaws that you identified in your declaration, the improper treatment of outliers in the 2008 study?

A. Yeah. So the way that outliers were treated was that they were simply removed from the analysis, and the justification was that these were in cases where the values were not provided by students or where they were significantly different by about 15 degrees deviant from the averages of the other groups.

And this goes against recommendations, including by the

National Institute of Standards and Technology, about how to handle outliers, particularly in measurement scenarios.

The rationale is that you should be designing your data collection process to really mimic what you're interested in; and, therefore, if -- if your data collection process generates something that that's aberrant, that is a property of your measurement device, which in this case is the person assessing the trajectory.

So to exclude it will lead to a poor estimate, and the -- the accepted approach is to essentially incorporate those outliers into the model or model them separately, but to exclude them summarily is not recommended.

Q. And, Dr. Bray, do you have a bottom-line conclusion with respect to the three study design flaws that you just testified about? So the blinding problem, the mixed methods problem, and the improper treatment of outliers that you just described?

A. Yeah. And that's the -- because of these problems, the blinding, the -- the out -- the treatment of the outliers and the failure to keep conditions consistent, that -- any -- any estimate that were to result from this data, regardless as if the analysis were perfectly done, wouldn't be appropriate for the application to a specific scenario.

Q. And when you say "application to a specific scenario," you mean application to one of the specific trajectory methods?

A. Right. So, for example, the rocker point method had a

shallow angle.

Q. Okay. So I want to switch gears and now turn to the statistical or computational errors that you identified in your declaration. And can you first start by describing generally how the 2008 study misuses the statistical concept of standard deviation?

A. Yes. So the -- the misuse of the standard deviation occurred in a couple of places. When it was introduced, the definition provided was not true. The English language definition. Additionally, the formula that was used, so essentially how it was computed, was incorrect.

I'm not actually familiar with the statistic that was used and represented as a standard deviation. I had never seen that being used. But then you can kind of decompose that further into the problem with defining the standard deviation, as they did, was that there was an issue with misordered operations in the computation and the other is improper weighting when they averaged various statistics together to come out with a final estimate.

Q. Can you say more about -- I want you to say more about both of those problems that you just mentioned -- the misordered operations problem and the improper weighting problem.

Can you start, please, with the misordered operations problem?

A. Sure. So this requires sort of describing the way it was actually computed. This is Figure 2 in the declaration. Essentially, what they did, as far as I can tell, is, in a given workshop, for a given scenario, which is a given angle, there was a known angle and then several measurements that were made. And then the estimate of what they call a standard deviation but is not actually a standard deviation was calculated by averaging all those observations first, coming up with a single average point, taking the difference between that and the true value, the known angle, and then taking its absolute value. We'll just say we'll call it positive regardless if it's positive or negative.

And this -- it kind of flips an important operation if you're trying to have this stand in as a measure of dispersion of data of variability. And as an example, imagine if you had a data set -- imagine that the true angle in this scenario is 35 degrees and that you have observed an observation of 30 degrees, 40 degrees, 20 degrees, and 50 degrees. So by this operation, first you would average those. The average of those four numbers is 35. So the difference of that mean to the known value is zero. So this statistic would say that there's zero variability there. Yet, you have a wide range of values spanning from 20 to 50. So that's what I mean by misordered operations.

Q. And what is the appropriate order of operations to use --

A. So if you were to --
Q. -- in that example that you just gave?
A. Yeah. So I guess if I were to correct this statistic a bit -- it still wouldn't be a standard deviation, but corrected a bit, I would take the absolute deviation of each measurement from the true value -- so some are positive, some are negative, but they all become positive -- and then average those deviations.
Q. And would fixing that problem with the order of operations solve the problems that you see in the study with respect to the misuse of standard deviation?
A. No, it wouldn't, because it still wouldn't be a standard deviation. It would be a measure of dispersion. But you would need to do something different to perform the cone of probability. The cone of probability is a combination -- it requires both an accurate standard deviation and reasonable knowledge that you're working with a right distribution; in this case, the Gaussian distribution. And this statistic, which is not a standard deviation, could not apply to the Gaussian distribution. It's parameterized in terms of the standard deviation.
Q. In addition to the misordered operations problem that you just testified about, you also write about an improper weighting problem in your declaration; correct?
A. Yes.

Q. And can you describe the improper weighting problem for us?

A. So this describes the process by which the paper goes from a single estimated statistic of dispersion, this one that's in Figure 2, to an overall across all of the scenarios and across all of the workshops. The first step was simply -- say, if there were seven scenarios, seven angles in a given workshop in a given year, computing each of those statistics, each of those absolute differences between the average and the true value, and simply taking their mean. And the problem with this is that it's absolutely the case -- you can look at the data -- that some of these groups, some of these scenarios, don't have the same number of observations.

So, essentially, if a scenario where only two measurements is going to carry just as much weight in assessing the variability as a scenario in which there were 15 measurements made, the appropriate way to address this is to take a weighted average where essentially an estimated statistic that was based on lots of data would carry more weight in computing that average.

This mistake is repeated when going from a single workshop to across all of the workshops. They simply average across all the workshops without regard to the fact that there's a different amount of data in each one of those workshops.

Q. So I think the last problem that you talk about in your

declaration, with respect to the statistical errors in the 2008 study, is the unjustified use of the Gaussian distribution. Can you explain that further? You touched on it already, but can you explain that further?

A. Sure. So the Gaussian distribution is the bridge that brings you from an estimate of the standard deviation, the variability in the measurement process, to the ability to make some statement about within this interval we're fairly certain, 95 or 99 percent confident, that the true value lies within this, which is what the cone of probability represents. The bridge that was used was the Gaussian distribution. This is probably the most common distribution to use in measurement scenarios. However, it's important that the -- you go through some basic checks to make sure that the shape of your data is in accordance with the Gaussian distribution, that it looks bell-shaped.

And, to my knowledge, that wasn't done. It could be done, given that the data is there, but it wasn't done. And because of that, the -- there -- that bridge going from the standard deviation to that final cone of probability is uncertain.

Q. So that is a form of extrapolation that's been done in the 2008 study that hasn't been justified by the checks that you just mentioned?

A. Correct. And it could be that the -- there -- there are some reasons to want to check. The paper describes how --

well, there are outliers and that there are certain methods that are being used that can produce some extreme results. And generally the normal distribution has fairly -- not that many extreme values. And if you're working with a process that has the tendency to sometimes generate extreme values, it's -- you wouldn't want to use the Gaussian distribution. You are going to want to use a different distribution to form that final cone of probability.

Q. And these two different statistical or computational errors that you've testified about, the misuse of the standard deviation being the first error and the unjustified use of the Gaussian distribution being the second error, have you reached a bottom line conclusion regarding the impact of these statistical errors on the reliability of using the plus-or-minus-5-degree uncertainty cone for the rocker point method?

A. Yes. So these -- these flaws are non-trivial. It's taking an established statistical method, which is the confidence interval, and misappropriating it or at least using it incorrectly. And, as a result, I wouldn't recommend the use of the plus-or-minus-5-degree cone of probability based on this analysis.

Q. For any of the three methods?

A. For any of the three methods.

MS. FERGUSON: That's all I have.

THE COURT: I have a question before -- it's a logistic -- you are at Reed?

THE WITNESS: Correct.

THE COURT: You're on summer vacation?

THE WITNESS: Correct. I'm not sure I would define it as vacation.

THE COURT: The other party here only got your report this morning, as did I. They have not had a chance to consult with another statistician or otherwise. Would you be available if -- after today, when they finish their cross-examination, with the material that they've had so briefly, would you be available for re-call for cross-examination?

THE WITNESS: Yes.

THE COURT: You're in town?

THE WITNESS: Yes.

THE COURT: Good. All right. With that, go ahead, Counsel.

MR. SUSSMAN: Thank you, Your Honor.

CROSS-EXAMINATION

BY MR. SUSSMAN:

Q. So, Dr. Bray, as I read your CV, you received your Ph.D. in statistics in 2013?

A. Correct.

Q. You're now an assistant professor of statistics at Reed

College?
A. Correct.
Q. Where did you receive your training in ballistics?
A. I have no formal training in ballistics.
Q. Or in trajectory measurement?
A. I have no training in trajectory measurement.
Q. So you're not a firearms expert?
A. I -- my expertise in firearms is restricted to the documents that I consulted here, which are listed in my declaration.
Q. So you're not a firearms expert?
A. Correct.
Q. Or a ballistics expert?
A. Correct.
Q. Or a trajectory measurement expert?
A. Specific to trajectory measurement, I would say no; but I think this general process of assessing measurement uncertainty is absolutely what statisticians do.
Q. I understand that, but I'm not talking about statistical probability calculation. I'm talking about calculating the trajectory of a bullet that struck an object. You're no expert in that, are you?
A. I have the expertise to assess the statistical methods that are used. If a statistical method is employed, as is the case in the cone of probability, then, yes, I'm qualified to

assess that.
Q. But if I were to have you pick up that ballistic rod on top of that box over there and go measure a hole, could you tell me, based on that measurement device, what the trajectory of the bullet that made that hole was?
A. I would defer to the -- to ballistics experts for the actual measuring of the trajectory.
Q. So then getting back to my original question, the answer is, no, you're not an expert in the measurement of a trajectory of a bullet; right?
A. I have expertise in assessing uncertainty in measurements. I'm not an expert in measuring in the actual mechanism of measuring a trajectory.
Q. And you weren't present when Mr. Haag measured impact "W" to LaVoy Finicum's truck, were you?
A. No. Correct.
Q. You were not present when Victoria Dickerson measured that same ballistic trajectory, were you?
A. That's correct.
Q. So you have no idea what methodologies they actually used to actually measure the impact at measure -- at -- measure the trajectory at impact "W," do you?
A. Well, insofar as if -- if the evidence presented is constituting a statistical analysis, a statistical analysis should hold regardless of who is actually conducting the

experiment.
Q. Let me put it to you this way: You can't say whether or not the methodology used to measure the trajectory back from impact "W" was scientifically reliable, can you?
A. Could you explain what you mean by "scientifically reliable"?
Q. That, sir, has been the debate of this entire hearing. But what I'm getting at is is you cannot comment on the propriety or reliability of the -- of -- in terms of measuring trajectory of what either Ms. Dickerson did or what Mr. Haag did; correct?
A. That's incorrect. What they did was use a very established statistical method called a confidence interval to form the cone of probability, and I have expertise in that.
Q. So then can you say whether or not the way in which Mr. Haag measured the trajectory back from impact "W" was reliable?
A. I can say that his suggestion to generally use a plus-or-minus-5-degrees is not scientifically valid.
Q. Not my question. My question was was his measurement itself reliable?
A. That would depend on the properties of the measurement process, which is what he's trying to capture in his 2008 paper with the cone of probability.
Q. Can you tell us, sir, whether or not Ms. Dickerson's use

of a centering cone was a reliable method of measuring trajectory in this case?

A. My focus on this was on the plus -- the recommendation to use a plus-or-minus-5-degree range for the cone of probability.

Q. So your answer is, no, you can't comment on that?

A. If it doesn't pertain to that plus or minus 5 percent, then no.

Q. Can you comment on the reliability of Mr. Haag's use of the rocker point method to measure the trajectory back of impact "W"?

A. I can comment insofar as it informs the use of a plus-or-minus-5-degree --

Q. But the measurement itself?

A. Depends on the properties of the measurement process, which is not well-established by the 2008 paper.

Q. Okay. And you can't say, then, which of the two methods would have been the better method to use under the circumstances present at impact "W"?

A. Better method to use? So the uncertainty in the two methods is not established. I would defer to the -- my only knowledge about which method to employ is -- comes from the Noedel report, the 2008 paper, where they suggest circumstances under which the rocker point method is preferable.

Q. Mr. Noedel is an expert retained by the defense in this case; correct?

A. I believe so.
Q. And he was critical of Mr. Haag's work and Ms. Dickerson's work; is that correct?
A. I would have to reread to know if I would characterize it that way.
Q. And you were retained by the defense in this case as well?
A. Correct.
Q. And did they tell you that they had some concerns about the statistical validity of Mr. Haag's 2008 article?
A. They asked if I could comment -- could assess the degree to which it was statistically valid.
Q. Did they tell you when they retained you that they believed there was a major statistical flaw in the article?
A. They said that they were -- they had reservations about the statistical validity of the article, yes.
Q. And that's the viewpoint from which you approached it?
A. That was the information that I had when I first read the paper.
Q. Now, did you review any of the raw data that formed the statistical basis for the article?
A. I primarily was looking at a couple of the first scenarios to try to back-engineer what exactly the statistic was that was being called a standard deviation. So to the extent that I did some spot checks to -- basically to figure out the formula that stayed in Figure 2, yes.

Q. Okay. But you didn't have all the raw data, just some of it?

A. I mean, it's all here. I haven't reanalyzed it.

Q. All right. That was going to be my next question --

A. Okay.

Q. -- is did you -- you know, you criticized the standard deviation calculations and some of the other calculations, like the averaging that Mr. Haag did. Did you do your own calculations to determine what the actual standard deviations should have been for any of those -- any of those parts of the study?

A. The -- the actual standard deviation that's needed to form this cone of probability requires both an appropriate statistical analysis and an appropriate study design. So there's a degree to which you can -- this could -- I did not reanalyze the data. I did not use the correct formula for the standard deviation. Even if I had, that wouldn't be an appropriate standard deviation to use for the formulation of a cone of probability because of the problems stated with the study design. You can't change the fact that the data was collected improperly.

Q. Let's talk about the study design. This was actually a compilation of data that was accumulated over the course of many courses that were taught by Mr. Haag; correct?

A. That's my understanding.

Q. So this wasn't an instance where they designed a study to test a particular hypothesis; right?
A. The way that the paper reads, it was not designed -- they're not trying to test a specific hypothesis. They're trying to estimate an uncertainty in a procedure.
Q. It involved a number of different firearms training workshops; correct?
A. Correct.
Q. Held at a number of different locations; right?
A. Uh-huh.
Q. Is that a yes?
A. Yes.
Q. Over a number of different years; correct?
A. Correct.
Q. And it included different experience levels of the people who were going through the course; right?
A. That's my impression based on reading it.
Q. Because it wasn't designed to be a statistical study. It was designed to be a learning experience for the students; right?
A. I'm not sure. I -- I could infer that, that this was not designed -- this data was not initially collected with the idea that it could be used to form a general statement about the reliability of this method.
Q. Right. This was data that was collected during training

sessions that Mr. Haag put on for people who were getting trained in doing ballistic measurements; correct?

A. Correct.

Q. And their knowledge and skill and experience levels varied from student to student; correct?

A. I would assume so.

Q. And I would assume, also, from seminar to seminar; right?

A. I would assume so.

Q. And if you're trying to teach people how to do something, is the best way to teach them to go double-blind on them, or is the better way to teach them to do something that they can actually learn from?

A. I think that brings up a really good point, in that if -- if the objective is to have a firm understanding of the uncertainty of this measurement method, you would absolutely want to disambiguate those two things. Your teaching a workshop is one thing and a certain goal in establishing on the uncertainty of this procedure is a very different thing. And I think you bring up a good example of where those two goals collide.

And the former, which is to say the establishment of the uncertainty of the measurement method, would require the blinding of the student evaluators.

Q. Let's talk about the blinding of the student evaluators for a minute.

MR. SUSSMAN: May I approach, Your Honor?

THE COURT: Of course.

BY MR. SUSSMAN: (Continuing)

Q. This was from an exhibit that was shown to Mr. Haag. This is on page 150 of Mr. Haag's article, which I believe you've already had a chance to review. Am I correct?

A. Correct.

Q. Now, as you see in the top picture on page 150, there's a number of Xs spray-painted on the pavement in kind of an arc around the white vehicle?

A. Yes.

Q. And then there's a number of numbers that are spray-painted below each one of those Xs; right?

A. Yes.

Q. And then a number of gunshots were fired into the vehicle from various positions marked by the Xs; correct?

A. That was my understanding.

Q. And then the students would go through and measure those gunshots to try and determine what the trajectory is; right?

A. That was my understanding.

Q. But they wouldn't know, as they're looking at the gunshots, which of those Xs and which of those numbers individual shots lined up with, would they?

A. I'm -- I don't know. It depends on the order in which the procedure was done. So if they did this sequentially, then, I

mean, you could see that there, to start, would only be one X on the ground, and then measurements were made; then the next X appears on the ground, more measurements were made. So in that scenario, they absolutely would know if they were all done beforehand. Then they at least wouldn't know the direct correspondence, but they would have a menu to choose from.

Q. A menu of at least five different shooting positions?

A. Correct.

Q. Okay. And you don't know which way it was done one way or the other; right?

A. It's not recorded in this study.

Q. Would you agree with me, sir, that there's some disagreement among statisticians as to how to treat outliers?

A. I would agree that there's a variety of opinions.

Q. And that some of those opinions are that it's okay to chuck the outlier so long as you state in there you're doing it and why you're doing it; right?

A. I think that would be a minority opinion, and that's established in the standards by the National Institute of Standards and Technology. I mean, they kind of set the standard about how to treat evaluator -- or outliers when you're doing one of these measurement calibration procedures and they're unambiguous. In fact, they're quite a bit more draconian about it than the average statistician, and they're saying that they categorically must be retained versus an

alternate which says you need to -- they should be retained but need to be modeled.

THE COURT: Your definition of "outlier" is what?

THE WITNESS: This is the -- well, I guess the definition used in the paper, which is to say it seems that angles that had -- that deviated from the others by more than 15 degrees or simply were not recorded by students were considered outliers. That's the definition.

BY MR. SUSSMAN: (Continuing)

Q. Which raises another good point, which, if the student didn't record a value, how do you figure a non-recorded value into a statistical analysis?

A. Yeah. So that, I would actually treat separately. So there's an approach of analysis called "missing data analysis" where simply dropping -- if you have bodies that simply were not recorded, it's kind of on first blush you would like to just drop them, but depending on the pattern by which they're missing, that can actually really perturb your final estimate. So there's a whole suite of methods called multiple imputation that's used to treat missing data.

So I would separate those two processes into missing data analysis and the treatment of the outliers.

Q. Now I would like to ask you a couple of questions about some of the stuff that you had in your -- in your declaration. One of the things, which is at the top of page 2 at

paragraph 7, is you talked about the observer knowing the true value, and that was -- that was -- we talked about that just a moment ago where they may or may not have. You're not sure; right?

A. They -- it seems likely that they had some information. You know, even having a menu, if that was the actual way that it happened, where all the Xs were drawn on the ground first, that provides some information. If he were drawn sequentially, then they actually know the true value.

Q. Now I would like you to take a look at page 5, paragraph 22. You make reference to the presence of extreme outliers and the inclusions of scenarios suspected to lead to aberrant measurements; i.e., shallow-angle shots and the rocker point method.

Where did you come up with that, that shallow-angle shots and the rocker point method were suspected to lead to aberrant measurements?

A. That's from the -- one of the concluding paragraphs of the analysis of the 2008 paper, I think. Would you like me to try to find it?

Q. No. Don't take the time to do it.

A. Here we go. It's on page 152. "On the opposite side of the coin, however" --

THE COURT: Don't go so fast.

THE WITNESS: Sorry.

"On the opposite side of the coin, however, there's situations that may require greater amounts of variance, such as, one, shallow-angle impacts" -- and he goes on.

BY MR. SUSSMAN: (Continuing)

Q. And where were the words "use of the rocker point method" in that paragraph?

A. It's a combination of that paragraph and the paragraph at the bottom of page 149, which states, "Additionally, for shallower shots fired through sheet metal where significant deflection has occurred, trajectory rods give the most accurate representation of firearm location when the lead-in portion of the defect is used," which, to my understanding, describes the rocker point method.

Q. Okay. Now, you said, sir, in your opinion, that the 2008 study shouldn't be used to statistically validate the plus-or-minus-5-degree variance for any of the three methods discussed in the article; is that right?

A. Correct.

Q. Were you aware, though, that there have been other studies in which other people have come up with the same plus-or-minus-5-degree margin of error for various ways of measuring ballistic trajectories?

A. The only information about that, that I have, was just from before I started my testimony. The discussion of a presentation, given by a ballistic expert, where he recommended

the use of the plus or minus 5 degrees.

Q. In fact, the use of plus or minus 5 degrees has been an industry standard even before the 2008 study; isn't that correct?

A. I'm not sure about that.

MR. SUSSMAN: That's all I have. Thank you.

THE COURT: Anything further?

MS. FERGUSON: No, Your Honor.

THE COURT: I have a question.

Could you take the statistics that are available and do it right?

THE WITNESS: So this gets into the issue of, you know, to have a really solid analysis you both have to have a data set that you can trust is capable of answering the questions that you want to ask of it -- that's handled in the study design portion -- and the second is that you do the analysis correctly.

And while the analysis could be corrected, it's still based on data that wasn't properly collected.

So it would be a limited use. For example, I would not want to use the resulting reanalysis for the establishment of a cone of probability for any of these methods.

MR. SUSSMAN: Your Honor, can I follow up on that, please?

THE COURT: Yes.

CROSS-EXAMINATION

(Continuing)

BY MR. SUSSMAN:

Q. Dr. Bray, so if I'm understanding your testimony correctly, in order to come up with a proper statistical validation --

Now, this is going to be a long question, so stay with me if you can.

THE COURT: That's all right.

BY MR. SUSSMAN: (Continuing)

Q. -- one would need to have a large number of students all with similar qualifications and experience; right?

A. It depends on what you're trying to -- the question that you're trying to answer in your study.

So by using students, the question that you're effectively answering is what is the uncertainty in this measurement method where you're putting students with trajectory rods through -- so if that's your objective, then, yes, that's how you do it.

Q. That was a poor question on my part. Let me start again.

You would need a large number of evaluators or examiners -- take your pick -- with a similar experience level; right?

A. Yes.

Q. A large number of shots fired and measured; right?

A. Correct.

Q. From a large number of angles; right?
A. If you think that -- so you need to -- if you think that these other factors, the experience level of the expert of the evaluator, the angle that was shot, if you think that that affects the uncertainty, then you'll need to collect data from across a range of angles, yes.
Q. Okay. Let's keep going.
Fired from a large number of weapons of different caliber; right?
A. Again, that depends on if you expect lots of variability from caliber to caliber and you want your method to then generalize to a larger class of firearms.
Q. Fired into a large number of different surfaces; right?
A. Correct.
Q. Using a large variety of different ammunitions?
A. I'm not sure the degree to which ammunition matters; but if it does, if it does contribute to the variability, it should absolutely be studied.
Q. Well, for example, you might have a fully jacketed round which would have one sort of impact, and then you might have a partially jacketed round that might have a different impact, and you might have, you know, a higher grain count in some ammunition and a lower grain count in others, and wouldn't you have to test all of those?
A. I mean, if -- if the caliber does change the measurement

procedure, the uncertainty of the resulting trajectory estimate, then, yes, you have to observe those to understand how they --

Q. It would have to be blind?

A. Yeah. If you expect evaluator bias to be a problem, which I think it's reasonable to do.

Q. And you would have to have all of those things, at the very least, in order to have a single statistically valid study; right?

A. Yes. I would refer you to -- in researching this and specifically trying to figure out what NIST recommends -- I'm sorry, the National Institute for Standards and Technology. They just published a report in February of this year that -- it's not assessing trajectory. It's assessing -- I think it's trying to assess firearm -- oh, it's trying to match a particular firearm it a particular shot.

Q. Toolmarks?

A. Yeah. And that is a really well-designed -- I mean, that accords to the standards of NIST. It is performed not by students in the context of a workshop, but specifically with the intent to assess the uncertainty in this method, and it was done by a team of both engineers and statisticians.

Q. And you wouldn't put any reliance at all on the fact that multiple examiners with years and years and years of experience, who have done empirical study after empirical study

and empirical test after empirical test and come up with essentially the same conclusion, that plus or minus 5 degrees, is it an appropriate standard for the industry? That carries no weight with you?

A. It -- it carries some weight. I think there's some information that's been learned, but when -- you know, this paper is trying to -- it's using a statistical method called the confidence interval to establish this very precise uncertainty statement that we can be highly confident that if you take your trajectory measurement, add or subtract 5 degrees, you'll have -- you'll contain the true value with -- with high confidence and -- and that -- I'm sorry. I totally lost my train of thought.

Q. Let's set aside the study for a second. We've got a lot of very experienced firearms and ballistics examiners across the country, and, in fact, around the world, who have lots and lots of experience measuring lots and lots of bullet impacts, and their combined experience suggests that an industry standard of plus or minus 5 degrees applies in most contexts and most situations. That carries no weight with you?

A. I said it did carry some weight, but I don't consider that statistical evidence.

Q. But it's evidence?

A. It's a form of evidence, yes.

MR. SUSSMAN: That's it. Thank you.

THE COURT: Anything further?

MS. FERGUSON: No, Your Honor.

THE COURT: I wanted to thank you. I don't know whether you're a pinch-hitter or a designated hitter, but you did come in at the last minute and you -- logistically, you're of great aid to the Court. Thank you.

THE WITNESS: You're welcome.

MS. FERGUSON: Would the Court like for me to move in the exhibits that were used with Mr. Haag --

THE COURT: Yes, please.

MS. FERGUSON: -- on the cross?

Those were from binder 5. So 5-1 all the way through 5-11. 5-16, -17, and -18. And 5-23, -24, and -25. And Dr. Bray's CV and Dr. Bray's report were marked 7-1 and 7-2.

THE COURT: Thank you. Our next witness?

MR. ANGELI: Can we have a moment, Your Honor?

THE COURT: Yes.

Do you want ten minutes?

MR. ANGELI: Please, Your Honor. Thank you.

THE COURT: We'll be in recess for ten minutes.

(Recess taken.)

THE COURT: What do we have next?

MS. FERGUSON: The defense calls Matthew Noedel.

DEPUTY COURTROOM CLERK: Raise your right hand, please.

MATTHEW NOEDEL,

called as a witness in behalf of the Defense, being first duly sworn, is examined and testified as follows:

THE WITNESS: Yes, I do.

DEPUTY COURTROOM CLERK: Thank you. Please have a seat. Speak directly into the microphone and state your name, first and last, and spell it for the record, please.

THE WITNESS: Matthew, M-a-t-t-h-e-w. Noedel, N-o-e-d-e-l.

DIRECT EXAMINATION

BY MS. FERGUSON:

Q. Good afternoon, Mr. Noedel. Can you please tell us how you are currently employed.

A. I currently run my own forensic consulting business called Noedel Scientific.

Q. And you previously worked in the Washington State Patrol Crime Lab for 15 years; right?

A. That's correct.

Q. And you have science degrees from both the University of Montana and California State University?

A. Correct.

Q. You're also a member of five different professional associations for forensics?

A. Yes.
Q. And you have a certification in crime scene construction from the International Association for Identification?
A. Yes, I do.
Q. And you also have a certification from the Association of Firearm and Tool Mark Examiners?
A. Three certifications from that organization.
Q. And over the years you've participated in many different workshops and seminars, courses and conferences, that have involved bullet trajectory analysis?
A. That's correct.
Q. And those are listed in your CV, which has already been submitted in this case; correct?
A. Yes.
Q. And your CV also lists over two dozen articles and presentations, many of which relate to trajectory analysis?
A. That's correct.
Q. And in addition to your writing and research in this area, you also teach courses on trajectory analysis?
A. I do.
Q. And which different methods do you teach to your students in those courses?
A. I try to teach a fairly comprehensive range of techniques and methods. With students, it's best to start on the simplest and most reliable processes first, which I -- I call the

two-point method or multiple-point method, whereby a rod, which is used to represent the bullet path, is inserted into two bullet perforations. From that stability, it's a great platform to show students how to record the values of the left and right, or horizontal, and the up/down vertical angles. And then I go with techniques and methods from there.

We may replace the rod with a laser light, which is a straight beam of light, instead of a physical rod. Other techniques that I employ include a method called the ellipse method, which is a technique that uses the shape of a well-formed bullet hole to calculate the angle from which it came.

THE COURT: How do you spell that?

THE WITNESS: E-l-l-i-p-s-e. That's a useful technique.

I describe how to use centering cones properly in the application of oversized bullet holes, consider how to address ricochets and those kinds of techniques. I think specifically of interest here, I don't typically teach a rocker point or lead-in method because I find that it's a fairly advanced concept, and it's very -- in my opinion, very subjective to apply.

Q. Can you please describe what you do to stay up on the new literature that is being published in the field of bullet trajectory analysis?

A. The professional organizations that I'm a member of all have publications that come out, so I -- I subscribe to all of the professional journals that are appropriate in identification, crime scene reconstruction, crime scene processing, and firearm and toolmark analysis.

Beyond that, I find a great way for me to stay current and contemporary is by teaching. For every -- every time I teach a class, I see something unusual or something new, and it forces me to learn and read in the literature what is being done in contemporary examinations. So I use those kinds of techniques in reading the journals, teaching courses, and preparing presentations at regional and national meetings to form the basis of my continuing education.

Q. And what different methods have you seen described and defined in the literature in this area?

A. Clearly, the most commonly referenced procedure is what we have been calling the two-point method, whereby two -- two bullet holes, bullet perforations, along a straight line, with little or no deflection apparent, can be connected by a straight line, a rigid rod, or a straight laser light, and that straight line can represent the bullet path. So now, instead of having a fleeting bullet going through the wall, we have a solid representation of the path.

From that solid representation, you can use protractors and tools to measure the horizontal, left/right and up/down.

So that's -- that's the primary method that's discussed in the literature.

The next most common one I see is the ellipse method, and that's why on a well-formed bullet impact you can -- you can measure, with a pair of calipers or a sophisticated ruler, the width, how wide it is, and the length, how long a particular bullet hole is. That ratio can be run through a mathematical formula, and you can calculate the actual angle from which it came from.

That is a good method when it presents itself because, like the two-point method, it's very stable. That method is reproducible. I can take a photograph and show you how to -- with a scale, how wide and how long and exactly what it is I measured.

Centering cones are sometimes used. I don't consider centering cone a true method, as we've been speaking of it here. Centering cones are a device that assists us in getting the cones properly aligned. And the problem that we have is here on earth, with gravity, if the cone -- if the rod is smaller than the bullet hole, gravity pulls it down.

Well, we know the bullet likely went through on, say, a straight-in shot. It didn't go through the bottom edge. It went right through the metal to create a circular hole. In outer space we wouldn't have to use centering cones, but -- because gravity wouldn't pull them down, but here we have to

use centering cones.

So once you establish the path that you believe the bullet took, if your rod sags, you can insert a centering cone to align it along the path that you've established.

So not so much a method as an assist to a multi-point evaluation.

Q. And you -- and you've seen that described in the literature?

A. Yes. There are a variety of -- of articles and textbooks that describe this process. Many of them have diagrams that show what happens when you let the rod sag. Now it's pointing too low because gravity has pulled the rod down. It actually originated from higher up. So all of these techniques are meant to be backtracked to try to estimate the area, the general area, from where a shot originated.

Q. And in terms of the literature on rocker point method or lead-in method, what do you see in that body of literature?

A. I find that very sparse in reference, and it's, particularly for this case, as this became a -- more of an important -- it -- event in this case or an important technique, I began searching back in the literature to try and see where these techniques originated from. And aside from finding some of these -- these references that say very little about how to do it, they mention you can sometimes use the front edge of a bullet defect, and others say somebody may call

that the lead-in area.

But, in these references, that's all that's ever said about how you use that lead-in and front edge area. So the literature is not clear at all about whether you call it lead-in or rocker is irrelevant. But the few mentions of using the front edge of a bullet impact are not clear in how you would use that, and they're not clear in what are the pitfalls and the advantages that you need to look out for if you're going to attempt such an analysis outside of the bullet holes.

Q. And putting the literature aside for a moment, can you please describe your experience with casework on bullet trajectory analysis?

A. My personal experience with bullet trajectory?

Q. Yes. In casework.

A. Yeah. So currently, as a private consultant, I work about, oh, 40 or 50 cases a year. Most of them involve some form of shooting reconstruction. Formerly, when I was with the State Patrol Crime Laboratory, I had a dual responsibility. One of my responsibilities was I was in call-out, so I could go and attend crime scenes. The two areas we were usually called out for were bullet path analysis and bloodstain pattern analysis. And those are two technique -- two areas of examination where it's easy to lose your skill. So somebody may take a course one time a few years ago, not use those techniques, and find, all of a sudden, a small county has a big

shooting event. So they would call -- could call us.

So that was my responsibility, then, within the state patrol -- to attend the scenes.

So now I sometimes re-attend scenes, if a car, for example, has been preserved, or I can examine the documentation of another examiner and try to evaluate what techniques were used, what was the process being done, what is left to consider.

So it's a combination of attending scenes now and looking at documentation of scenes to evaluate what was done and was it done properly.

Q. And in your -- in your casework, can you describe your experience with using a plus-or-minus-5-degree uncertainty cone for an estimated bullet path?

A. Yes. The -- the plus-or-minus-5 is a very interesting number, and it's a very -- in my opinion, a very convenient number. Originally, when people first started considering where did a bullet come from, some detective in the 1930s puts a pencil in the wall and says, "It came from over there." As time goes on, the criteria became a little more and more stringent, and then someone attaches a string and says, "We can track the string." So that was kind of it. The technique was always used for kind of saying, "Kind of over there."

Somewhere around the 1970s, 1980s we began to get more and more stringent, and people began thinking about, well, maybe we

can use a protractor and actually measure the angle. Fast forward into the '90s and as -- I blame DNA, but as more and more sophisticated statistics were coming available, we found ourselves in the ballistics field kind of trapped in this old "pencil in the bullet hole," so we began to look for validation.

Doing so, most people with experience were comfortable in saying, "If I have two nice stable points, I feel like I'm surely within plus or minus 5 degrees," not based on measurements and not based on studies, but just on the feel of how solid the two points that we're connecting are.

All of the textbooks are common, and they all warn that as the variables change and as the irregularities of the scene or the process increase, you have -- you may have to open that cone, and to -- and the suggestion is to not fall in love with absolutely plus or minus 5.

So to answer your question, I have adopted that kind of assessment.

Two very solid points, for example, we heard about the -- the study when Mr. Haag came back, and he talked about a presentation that is yet to be published. I was at that presentation as well. That was a great study. It was a solid wall with two pieces of drywall, two known holes, and they were marked A and A1. So the students knew which two points to connect. It was a measure of how well they could read the

protractors off of those walls.

So that's great application of a plus-or-minus-5, and they found that students -- even students could do plus-or-minus-5 with that kind of an application.

That's a very far cry from a bullet that's going -- a rifle bullet, first of all, going three times faster than a handgun; a bullet that's a much longer profile than a handgun bullet, which is short and stubby; irregular surfaces, all kinds of irregular surfaces on vehicles; and striking something very hard like car metal.

So when we start adding these variables, these complications to that simple two points along the line, we have to begin increasing our error.

The problem is we don't know how big our error is because we've never done these comprehensive studies that would tell us how much the two-point method varies between drywall and plywood, for example, or between plywood and a carpeted floor. So we would have to start studying these variables, and then, under the statistical guidance of somebody who was -- who was well-versed in statistics, not a firearm examiner who would use a statistician, calculate what these ranges -- what is appropriate for us to see.

It's a similar approach that DNA took. How certain are we that these characteristics can be statistically calculated? So we would need to do -- go through that process and begin to

validate the various things that we're examining. And I agree with the statistician who spoke about isolating these techniques. You can't use a two-point method on a wall with drywall and a single point hole in a car and saying that they have the same error. Those are two completely different surfaces that are reacting completely different to a 3,000 feet per second projectile and impacting them.

So I believe that the literature and that the conservative way to handle the uncertainty is to evaluate each situation. It's not to simply use a plus-or-minus-5 for every case scenario.

Q. If you were asked to place the stability of the three methods we've been talking about in court today -- the two-point trajectory method, the centering cone method, and the rocker point method -- if you were asked to place those on a spectrum, their stability on a spectrum, what would that spectrum be?

A. So the most stable is, of course, two points through a fixed -- a fixed object. Two points through a wall or -- or two points through a stationary fixed object that can't move. So that's the most solid.

The centering cone method is essentially -- in this case, it's a -- it's kind of a single point method. It falls short because that method, the rod that is representing the bullet path is only anchored at the middle, and it can wiggle and

wobble quite a bit until we shove something in there to stabilize it.

So the question becomes, with both ends being able to wobble, how do you know when you've got that aligned? And in this case the hole is much larger than the rod itself, so you can move left and right, and you can move up and down.

If we use a centering cone, what that does is necessarily center that -- points that to the middle. And that's the only true place of the centering cone if the bullet actually went through the middle. If the bullet happened to wobble a little left, the centering cone is going to pull that back to the middle. It doesn't care where the bullet went. The centering cone is filling in the gaps outside of this massive hole that's taking up that space.

So because that has wobble, I consider that the second most stable, because we can help ourselves with the centering cone.

The third and what I consider the least stable technique, I believe, is the rocker point. And the problem that I have with the rocker point method is that rather than using the middle part of a rod to stabilize it or to fix points in the rod, you're using the last -- we were hearing millimeters, maybe a centimeter, 10 millimeters in length, to evaluate the entirety of the arrival of the bullet.

And what my concerns are with that technique is it's very

sensitive to slight changes.

First of all, I never know if I'm feeling the same sweet spot as another examiner is feeling. You can't -- you can take a picture of where you put the rod, but you can't take a picture of how you put it.

Because your trajectory rod is so short, that is you're using 1 centimeter of a trajectory rod -- so instead of having this nice 12- or 18-inch long trajectory rod, you're only using this little part. Yeah, this part of the rod is along for the ride, but you're using this part of the rod to measure the rocker point. That's a very small surface area, and it's going to be very sensitive to minor changes.

So if I'm a little high, a little low, a little too deep, or a little too shallow, that can affect the actual numbers that are associated with the rocker point method. Because it has those subjectivities is one of the reasons I avoid it.

Now, you do have to consider, when you have a trough leading into a bullet defect, that that is somehow involved.

My way of dealing with that uncertainty is I open up that plus-or-minus-5 because I'm not sure where on the left/right it actually went through the hole, and I'm not sure on the rocker, on the last centimeter of my rod, if I'm off a millimeter. I did some calculating, and it turns out that when you're using just that much of a -- of the rod, if you divert one millimeter, which is about the thickness of a credit card, or

so, to the left or right, you can change that degree -- that horizontal by 7 degrees in each direction, plus or minus 7 degrees, for a 14-degree range. That's if you're off by one millimeter on the back end.

Perhaps you can learn and become proficient. I don't know. But that's the subjectivity that concerns me with the rocker and why I think it is the most sensitive of all of the techniques.

It was also mentioned that all of these methods have subjectivity to it. Completely agree. Everything we do in forensic science has a degree of subjectivity. But aligning two holes, where I get no wiggle, is much less subjective. These are not equivalent subjectivity. This is much more stable, aligning two holes, than holding 1 centimeter of a rod in the groove leading up to a bullet.

So there's subjectivity in all. They're not equal subjectivity.

Q. And can you talk about what happens when the two holes -- when you're using the two-point trajectory method, what happens when those holes get closer together?

A. Yes. So the closer that the two -- that the two supporting positions of a rod are together, the more unreliable they become, until we get to a point where there's two -- two perforations that are so close together that we can have a lot of swing. Imagine like putting a pencil between your fingers.

It's pretty solid right here. But I can wiggle the ends of that. So when I have a really large hole, as we see in "W," it's twice the diameter of the projectile that we believe caused that hole. It's twice as large as the bullet. There's a lot of play left and right.

So when those two points are very close together, I'm not sufficiently anchoring either end. I'm simply holding the rod in place at the middle, and that allows me for a lot of variability. And, again, it's a situation you may want to consider increasing your error rate.

Q. Now, you've talked about the subject -- the differences in the subjectivity of these methods and the differences in the stability of these methods. If you were asked to place the general acceptance of these three methods along a spectrum, what would that be?

A. I think it would be a similar sequence that I just gave.

The two-point method is clearly accepted and used by everybody who is practicing bullet path analysis. Many people use centering cones. Sometimes they are used properly to just support the rod once it's been placed. Sometimes they're improperly used to actually direct the path of a perceived bullet path because that cone can be wobbled in that oversized hole. And then the -- the third being the -- the rocker point would be the -- the least of the three.

Q. And if you had to place the peer-reviewed testing of these

three methods on a spectrum, what would that be?

A. Again, it would be -- it would be similar. The -- the rocker point method, as we're talking about it, is essentially a single point center of the cone method. Not a lot of data on how reliable that actually is because it depends so much on how wide you're trying to connect.

In our case, we have the headliners pressed up against the roof. I don't know how thick that is, but those two are two points that are very close together. By -- just by intuitively seeing how a headliner is placed on it.

Q. I just want to clarify for the record right now are you talking about the centering cone method or the rocker point method?

A. The centering cone method.

Q. I think you said the rocker point method.

A. Sorry. I apologize. The use of the centering cone, which is anchoring the rod in the middle, and it has a lot of play. I believe your question was the -- the --

Q. Peer-reviewed testing.

A. -- peer-reviewed testing of that.

So that's not tested specifically. The two points have been tested a ton. Everybody has that experience. Most reliable. Probably appropriate for what we're considering it, plus or minus 5.

The rocker point has very little published data. If you

go back through the articles that mention it, the textbooks that mention "use the shoulder" don't provide any data about the reliability or the use of that.

And then Mr. Haag's 2008 article is the other place where we see an accumulation of data, and he also mentioned sometimes you can use the front end. He doesn't identify anywhere which of his bullet paths were used with a rocker point method or some other method.

We heard earlier that you wouldn't even begin to use the rocker point method on real steep angles. 70, 80, 90 degrees. It's only shallow. So a lot of the data points in the 2008 study are automatically known to not be rocker point values. So we just don't know what, if any, of those were -- were used in the published literature.

Q. And are you aware of any other peer-reviewed testing of the rocker point method?

A. Yes. I -- the other one that was mentioned earlier today, Mattijssen and Kerkoff recently did a paper. I think it was in 2016. And they compared the ellipse method and the -- I believe it was a two-point method. Two-point, ellipse, and rocker point -- they call it lead-in -- methods, and their study tested five examiners who didn't know the answer, and a sixth who did, who actually helped set up the study. So they tested six examiners. Five are what we would consider blind to the experiment.

They don't describe the process of how they do it other than saying a few centimeter -- up to millimeters in the lead, and they did a statistical evaluation of those five, and they did good amongst each other, as far as their statistical -- I don't remember the absolute values of their statistics, but they were good. They were low.

But they didn't test horizontal angles with the rocker, and they knew that when they observed the sheet -- type of sheet metal they were testing was not consistent with what they were used to seeing in real cars and automotive metals.

So there's something different about when you paint and prime and treat and bend automotive metal, and it's behaving different than what they saw. And they noted that in their study, which tells me that they thought that that observation was important.

I don't know of any other studies that consider rocker -- rocker.

Q. And did you reach any conclusions about possible fragmentation or deflection of the bullet that caused impact "W" in this case?

A. I have -- I have an opinion of what I think is going on with that defect. I didn't conduct any external testing to verify it; but, yes, I studied the appearance of impact "W."

Q. And what is your opinion based on your study of the appearance of impact "W"?

A. In my opinion, I've heard people describing it as a very regular -- very consistent-looking hole. In my opinion, it's not that. We have -- when we begin to look at this from one side to the other, the lead-in area is an unusually long and thick lead-in area. That's that stripe of paint that's leading up into the bottom of -- of position "W."

The name of that feature is pinch point because it's typically a round circular island of remaining paint. It's why it's called a point.

So this is a long lead-in, and as -- as Mr. Haag showed us today, you can see it in other situations. But that is not a very common observance for me.

When you look very close at that defect, on top of that painted pinch point, that elongated pinch point, there is a stripe of black -- a strip of black deposit. I'm not sure what --

THE COURT: I thought it was white.

THE WITNESS: I'm sorry?

THE COURT: I thought the strip was white.

THE WITNESS: Yes, sir. The strip of curled paint was white. On top of that white paint there's a black stripe that runs diagonally on top of the black -- of the white paint.

MS. FERGUSON: We can try to get a picture up if that would help your testimony.

THE COURT: No, I see.

THE WITNESS: It's a smudge on top of the paint.

THE COURT: I can follow it.

THE WITNESS: Technically, both of those features, that fits kind of what's called -- what's known as a lead-in mark.

THE COURT: The white is the lead-in and then the black is what you're talking about?

THE WITNESS: Right. Well, the white is actually the pinch point and the lead-in would be the black if you looked at the --

THE COURT: Is that right?

THE WITNESS: If you look at the Haag definitions, the white paint would be the pinch point. And if you see -- if you look just to the right of those two pink dots, those are old paint artifacts.

THE COURT: They've been described as white paint.

THE WITNESS: Yes, sir. And what you're seeing there, the long piece that's the substantial part of this, is the pinch point or the pinch -- they're calling it the lead-in, as well, or that it's part of the lead-in. If you look on top of that white paint, toward the right side, you'll see a diagonal strip of black.

THE COURT: And that represents again?

THE WITNESS: That's called -- in Haag's textbook, he calls that a lead-in mark. A residual black mark at the

lead-in position.

The point with both of those is that those two features are typically used to identify the entry side of a bullet impact, and that's the common definitions are when you're trying to figure out when you have a low-angle shot, which way did it come? Left to right or right to left? Those cues will tell you what the front -- or the front side is.

Now, the rocker point method goes beyond that with pinch point and lead-in, and it lays something on top of all of that material.

Then as we go forward through this hole -- I've started at the bottom. So we have this long pinch point, a black stripe on top of it that's going off axis to that. Then we have some torn metal, and the metal is torn kind of diagonally. I'm not sure that you want your rocker point, if you were to use that method, to fall into that hole. That would throw your numbers way off.

And this view that I see on my screen, there's a torn diagonal piece that's leading into the hole that looks brown -- the hole is brown behind it, and there's this angled piece of metal. That is not the rocker point, but that's a dangerous area, because if you push the rocker point rod into that angle, you're going to get a dramatically different number. It's only a few millimeters beyond that lead-in -- the original lead-in mark.

Then we do have a --

THE COURT: He's talking about feel. Would the feel be in the top part or would it be in the center part?

THE WITNESS: It depends on where you push your rod. If you push the tip of your rod into that angled part, your rod will kick up.

THE COURT: Yeah.

THE WITNESS: If you pull your rod out so that you don't go that deep, then you'll feel whatever it is in front of that. And I think he is specifically considering the feel of what's in front of that, the shallow part of that lead-in for the rocker point.

So, to me, that's part of the subjectivity problem with this, is that you can miss the -- the sweet spot by as much as a millimeter and throw your numbers way off.

So as I consider this bullet hole further, I then have a fairly oval defect. It's about twice the diameter of a .22 -- .223 rifle bullet. And then at the very top of this defect we have a hump -- kind of like a top of a snowman. We have a large oval in this hump. That hump is somewhat, in my opinion, irregular.

So these combinations of feature are what I consider irregular so that when I look at this defect I'm already considering I may have to open up my range of uncertainty here because there are some features going on here that are going to

give me trouble.

I agree with your earlier testimony. As a crime scene analyst, I have to deal with this somehow. But I can't be wrong, so I'm going to open up my range, and that way I'm sure to accommodate whatever happens to be going on in this situation.

BY MS. FERGUSON: (Continuing)

Q. And with respect to the placement of the rod in that rocker point area, can you describe the consequence to the azimuth angle if the placement of that rod is off by a millimeter to one side or another?

A. Yes. So if I can just use my hands to represent it. If that's the trough, and you switch it by 1 millimeter, you roll 1 millimeter, about the size of the -- the thickness of a credit card, that will add 7 degrees to that direction that it slips.

So it's very important that the feel and the sweet spot be exactly defined. That creates some other problems for me in that. So should we have a specific caliber of rod to match the bullet that caused this lead? What happens if we use a real fat rod and a real skinny lead? I don't know the answer to those. I don't think anybody really knows.

So there are characteristics of that technique, I think, that need further exploration before we adopt it and certainly before we say that it falls within our plus-or-minus-5 range of

certainty.

One millimeter error can be up to 7 degrees of downrange error.

Q. And putting aside the potential for an examiner to be off by a matter of millimeters in the placement of that rod, do you have any other concerns about Mr. Haag's use of the rocker point method on this groove, in this case, with respect to the formation of that groove?

A. Well, it depends on how it was formed. I -- I'm not sure I'm following the question. Is it an exact representation of the .223 caliber bullet? Is it .223 inches wide like that bullet? Is it bent metal? What is actually causing that? Is it pressure ahead of it, kind of like leaning on the mattress and the other parts of the mattress go in and then you take your hand up? And we're looking at the metal that doesn't spring back. So some of those characteristics about how it's done, I think we should try to understand.

Q. Can you talk a little bit more about the spring-back that you just mentioned with respect to the metal?

A. Well, in my opinion, it's -- I think we want to understand how this is being formed.

In the case of this with a high velocity -- potential high-velocity rifle round that we're considering here, a .223 caliber, the bullet is relatively long, and the bullet is curved. Curved to a pointed nose, essentially. We call that

curved portion the ogive.

THE COURT REPORTER: I'm sorry. Could you repeat that word again?

THE WITNESS: Ogive, o-g-i-v-e. And that's the curved portion that goes from the solid sides to the pointed nose.

So is it the ogive that's causing this point and then causing the bullet to upset and tumble or twist or yaw? We heard a little bit about yaw and instability. It takes time for the bullet to go to sleep and settle in from when it leaves. So if a bullet is wobbling and then encounters car metal, is that skewing us a millimeter or two to the left or right?

So how that trough and how that metal is being bent I think is an important factor to consider whether or not we're going to use this and, if we do use it, what certainty we're going to assign to it.

Q. Could there have been stresses in the metal from the manufacturing process of that car that would have affected the formation of that groove?

A. That's a possibility. Sure.

Q. And could that have affected the way in which that groove points back?

A. In a minor sense, yes. It's a hard question to answer, because I -- I do believe that the bullet was coming from over

there toward there.

I think with us trying to focus it in such a narrow window is where we're missing the boat. There's no question in my opinion. This bullet didn't come from the front of the car back, so might it be very minor things, very minor changes in the surface of the structure and the stresses and the ridges and how they were formed? This is in between two ridges. Is there a lead-in stress to the ridges?

We know from the Kerkoff study that different metals appear different performance, so we don't really know that. So let's not be wrong about the rocker trough. Let's open up our ability. Of course it came from this direction toward that direction. But can we say to this narrow, narrow window? I don't agree.

THE COURT: Are you assuming a particular type of bullet, caliber?

THE WITNESS: I do have a particular caliber in mind, yes.

THE COURT: What?

THE WITNESS: .223 Remington is the name of the round.

THE COURT: You mentioned that earlier.

THE WITNESS: Yes, sir.

THE COURT: What's your basis for that?

THE WITNESS: In the data I was provided with this,

the guns in question that were in the area of what -- of the individuals who were in this relative area, or believed to be in this area, were armed with that caliber of firearm.

So you cannot look at this bullet hole and say it's a .223 bullet hole. So it could be an -- I don't believe this, but it could be an errant handgun round. It could be a .30 caliber bullet hole. It's large enough to accommodate that. But in the context of the -- the situation we're testing, I consider .223 rifle, and then if -- if there's more guns than that, then we need to open up even further.

BY MS. FERGUSON: (Continuing)

Q. And, Mr. Noedel, would you have used the lead-in mark that's on your screen in this case to determine the entry side of this bullet hole?

A. Yes.

Q. And you would have used the lead-in mark to determine the direction of travel of the bullet that caused impact "W"?

A. Yes. Yes.

Q. But you would not have used this lead-in mark to assign a specific azimuth angle to the path of the bullet that caused impact "W"; correct?

A. Not by itself, no.

Q. And why not?

A. Because I'm not confident that laying a rod in that lead-in mark is a reproducible and reliable way to evaluate

that portion of a -- of the bullet defect, and it's very subjective to the user.

Q. Do you have any opinion about the likelihood of horizontal deflection at the point that bullet struck that lead-in mark or made that lead-in mark?

A. Yes.

Q. And what is your opinion?

A. I believe some horizontal deflection is a reasonable expectation. While the bullet's momentum is going forward, certainly a bullet that is impacting hard metal and beginning to come apart can deflect both left and right while it's moving forward, as well as up and down.

THE COURT: Are you assuming some distance away?

THE WITNESS: The origin of the shot?

THE COURT: Yes.

THE WITNESS: No. Independent of the origin of the distance of the shot.

THE COURT: 30 feet versus 30 yards?

THE WITNESS: As far as deflection, I think it's going to be more of a function of bullet velocity. And if we're considering a rifle bullet, it does not lose that much velocity from 30 feet to 30 yards.

If we go very long range, perhaps 3- or 400 yards, now I'm going to be beginning to think about completely different properties. Because at that great distance, now I have to

start thinking about the parabolic path of the bullet as gravity works on it. So as long as we stay close range -- and by that I mean 30, 40 feet -- I'm comfortable considering it a relatively straight line path as it approaches.

BY MS. FERGUSON: (Continuing)

Q. Would the bullet have been spin-stabilized at a close range of, say, 15 feet?

A. They typically are not from a rifle. They're not spin-stabilized at that -- they have not, as we heard earlier, gone to sleep or stabilized. The bullet goes from stationary to, say, 40,000 psi in the chamber of the gun, and it jumps into the rifling, forced to spin for whatever length of your barrel is, and then it comes out. That spin, gyroscopic spinning, causes what we've been calling yaw, or that bullet to wobble a little bit, until the gyroscopic stability catches up with the mass momentum of the bullet, and then it's nice and stable.

That usually takes some distance depending on the gun and the ammunition.

Q. And so it's possible that a bullet fired from close range into impact "W" may not have been traveling on point; correct?

A. Correct.

Q. Mr. Noedel, you authored an initial declaration in this case that's dated March 29, 2018; correct?

A. Yes, I did.

Q. For the record, that declaration has already been submitted to the Court as an exhibit to the defendant's motion papers.

Do you adopt the contents of that declaration as part of your testimony here today?

A. Yes, I do.

Q. And you authored a supplemental declaration in this case dated May 14, 2018; right?

A. Yes, I did.

Q. That declaration has also been submitted to the Court as an exhibit to our motion papers?

THE COURT: They're both received.

BY MS. FERGUSON: (Continuing)

Q. Mr. Noedel, do you adopt the contents of that supplemental declaration as part of your testimony here today?

A. Yes, I do.

Q. And after you signed your supplemental declaration in this case, you received some additional material; correct?

A. I did.

Q. And that was material that had been provided by Mr. Haag; correct?

A. Yes.

Q. And that material included a handful of published articles; right?

A. It did.

Q. You were aware of those articles before you wrote your declarations in this case; correct?
A. Yes. I actually cited some of those in my first declaration.
Q. You cited, for example, the Mattijssen and Kerkoff 2016 study; correct?
A. Yes.
Q. And you reviewed those articles again, right, after you received them?
A. Yes.
Q. Did your second review of any of those articles change any of your opinions about the subjectivity and the sensitivity of the rocker point method?
A. Not at all.
Q. And did it change any of your opinions about the improper use of the plus-or-minus-5-degree uncertainty cone for impact "W" in this case?
A. No.
Q. And the additional material that you received from Mr. Haag also included photos and videos of two different tests that he conducted on the rocker point method; correct?
A. Yes.
Q. And one of those tests was done in November of 2017?
A. It was.
Q. And that test had a sample size of approximately 14 rocker

point measurements?
A. Yes.
Q. And the other test was conducted in April of 2018 and that one had a sample size of only five rocker point measurements?
A. Yes, I believe that's correct.
Q. And do you have an opinion about the size of those samples?
A. Yes.
Q. And what is that opinion?
A. I think that those are relatively small sample sizes to draw broad-based conclusions from.
Q. And did any of these tests change any of your opinions about the subjectivity and sensitivity of the rocker point method?
A. No.
Q. And did any of these tests change your opinions about the poor fit between the plus-or-minus-5-degree uncertainty cone that was used in this case to impact "W"?
A. No.
Q. And what kind of study would give you confidence about the use of the rocker point method and the plus-or-minus-5 cone on impact "W" in this case?
A. I think the first thing that we need to do, if we're to employ this method, is to define it and, rather than saying things like "some millimeters" or "just the end of a rod,"

let's find that out. Maybe we can even make a rod with a strip that says "insert to here." We don't have those methods and techniques.

So, first, defining a method. Once we have a method, then you can go through the protocols and test it by taking the types of test shots that Mr. Haag took and seeing if that method applied the same way over and over as reproducible. Having people blind, then, come in and take those tests. Is the method robust from person to person, or is this one test that one person has a personal ability to perform?

And then we can accumulate that data. Let's focus it to just the rocker point method. I would suggest, in this case, if you wanted to focus it with just rifle in .223 Remington caliber or just rifle in .30 caliber, control those variables down, and test just the one method. If it works for that method, then we can begin expanding, and maybe we'll find that it's -- maybe it traverses to other calibers in other situations, even other surfaces. Maybe this is something that would work on brick or tile floors or something like that. But we -- we haven't done the first part, which is define the method and test that method with the reproducibility and the controls that we would need.

Q. Can you talk a little bit about the difference between the test that Mr. Haag did and the kind of robust study using statistical methods that the 2008 study purported to be?

A. Yes. The two -- the new tests and the 2008 tests actually have some similar characteristics to them. The -- one of the situations is the person being tested always knew the answer.

And even if Mr. Haag was not directly looking back to his rifle, he knew where he shot from and he knew where the target was. So that is -- introduces a potential bias in how the method is -- is felt; how you -- how you organize and feel the rocker point.

So I think the first step there would be have someone else shoot and then test yourself and do that among a variety of people who are using the same technique, applying the rod in the same manner, hopefully feeling the same thing. But I think that's the kind of thing that needs to be done to advance this technique.

MS. FERGUSON: That's all I have for Mr. Noedel.

CROSS-EXAMINATION

BY MR. MALONEY:

Q. Good afternoon, sir.

A. Good afternoon.

Q. My name is Paul Maloney. Have we met?

A. I'm not sure. We may have.

Q. We were both out in November.

A. Oh, yes. Okay. So, yes.

Q. Okay. My questions this afternoon are not to trick you.

If at any point you don't understand, please stop me, and ask me to clarify, and I will do so. Okay?

A. Sure.

Q. You were hired in this case when?

A. I don't recall the exact date. I think it was early -- late October of 2017 --

Q. And --

A. -- or so.

Q. -- it was -- it's important in any analysis like this to familiarize yourself with the facts of the case?

A. Yes, I agree.

Q. Did you do that?

A. I did.

Q. And what materials did you review?

A. I reviewed the types of information I commonly request, which included -- I usually start with data about the car -- in this case the truck -- the crime lab notes and reports, any photographs that they had from the case. I often like to get some kind of a narrative that describes what -- what is being alleged in the case to get some context into what it is we're trying to assess and what would be the reasonable processes to use.

Q. Now, in your -- one of your declarations, you list the materials reviewed. I believe that's in your first declaration.

A. That could be.
Q. All right. Are those all the materials that you reviewed in this case?
A. Is it -- it's in my declaration?
Q. I believe so, sir.
A. Are you talking about the reference section?
Q. Yes, sir.
A. No. That is not all the materials reviewed.
Q. Did you have access to the full discovery in this matter?
A. No.
Q. Do you have your full case file with you today?
A. No.
Q. Where is that material?
A. That's in my office in Puyallup, Washington.
Q. And would you be willing to produce that?
A. Sure.
Q. What was the scope of the work that you were retained to perform?
A. Initially, it was to -- my first responsibility I was asked was to -- whether or not I could attend the reanalysis done by Michael Haag of the truck in Bend, Oregon, and was it -- would I be able to travel down there. I was available for that, and I was advised that I was to evaluate and watch the processes being used and then advise to the attorneys, "What are those processes?" and "How do they work?" and those

types of assessments.

Q. And were you able to attend the reanalysis in November?

A. Yes.

Q. And did you observe?

A. I did.

Q. You did more than observe; right?

A. I'm not sure what you mean.

Q. There were parts you were helping Mr. Haag?

A. On occasion, yes.

Q. Moving parts of the car, adjusting the liner inside the engine compartment?

A. Yes. We discovered fragments in the engine -- or he discovered them, and I helped -- would help hold that down so he could take a photograph.

I recall one time, when Mr. Haag was on his back under the truck, helping him up to his feet again. So, yes, I -- I don't dislike Mr. Haag.

Q. It was a collegial endeavor?

A. Correct.

Q. Now you're familiar with the scientific method?

A. Yes.

Q. And did you apply it to your work in this case?

A. No.

Q. Why not?

A. Because I was not performing a -- a specific analysis of

the -- of the truck. I was doing kind of a consultation approach to advise what was being done and being able to describe techniques that are useful in shooting scene reconstruction for the attorneys, not to reexamine the truck a third time.

Q. Sure. When -- and you observed Mr. Haag's examination of the truck specifically to impact "W"; right?

A. I did.

Q. When -- there's the photo that I think we've seen. You've been present throughout the testimony?

A. Yes.

Q. There's a photo that I believe Mr. Haag testified to with a ballistic rod bisecting "W." Do you recall that photo?

A. Yes, I do.

Q. What's the examiner's purpose in documenting that photograph?

A. It's my opinion that he took that photograph to try to establish a long axis of the damage to the roof.

Q. Why is the long axis to a -- an elliptical hole like this important?

A. If the hole were elliptical, the long axis would be half of the formula that we would want to use to calculate the angle of approach or incidence.

Q. Is there other information that you can adduce from that horizontal or with the -- with the rod bisecting the long axis

of the hole?
A. Yes.
Q. What other information can you adduce from that?
A. I -- I liken that to what I mentioned earlier. That's kind of like putting the pencil in the bullet hole. It points back to the area from which the shot originated.
Q. And in this case, knowing what you know about the positioning of the roof of that truck at the time "W" impacted it, would that give you general horizontal azimuth information?
A. Yes.
Q. You watched Mr. Haag secure that into position?
A. I did.
Q. And when he -- when he did take that picture of it bisecting, did it align with the lead-in mark?
A. Yes. I -- I believe that was the purpose of him aligning it in that manner.
Q. Now, you took photos of that; correct?
A. Yes.
Q. For identification purposes, sir, I'm showing you a series -- a series of three photographs. What is depicted here?
A. That is a photograph of a white -- the white trajectory rod fixed into the lead-in position and held by a strip of duct tape.
Q. Did you take that photograph?

A. I'm not sure. I would have to see the -- I would have to compare it to the actual photo numbers that I have. I could have taken this photograph, but I don't recall if I took this specifically.

Q. If I -- if you were to subsequently learn that it came from the defense in this case, would that be -- have been you that took this photograph?

A. In my opinion, if it's from the defense, it's my photograph, yes.

Q. And, for the record, that's Government Exhibit DH43.

What's the angle that you're measuring there?

A. I'm not measure -- the protractor is positioned to try to capture the horizontal angle. And are you asking the number?

Q. Yes, sir.

A. It looks like it bisects and goes over what I would call 30 degrees from left -- to left. 30 degrees left.

Q. That would be about 120 degrees from the front of the truck?

A. Yes, sir. Considering the front of the truck is zero and counting clockwise, we would get to 120 degrees.

Q. Did you note this measurement in your report or declaration?

A. No, I don't believe so.

Q. Showing you what has been marked for identification as Government Exhibit DH42, do you recognize that?

A. Yes.
Q. Who -- what is depicted in DH42?
A. This is the rocker rod in position, and an angle finder or an inclinometer has been placed on top of the rod.
Q. And what is the angle measurement there?
A. It reads approximately 8 or 9 degrees downward.
Q. And did you take that measurement and document it in that photograph?
A. This would be consistent with a photo I would take and capture --
Q. Okay.
A. -- when I was there.
Q. So 9 degrees downward is the measurement?
A. Somewhere between 8 and 9. The dial is not completely clear.
Q. Did you mention that you had documented this measurement in your report?
A. No.
Q. Just one last -- DH41. What is depicted here?
A. That is a side view of the rocker method -- of a rocker trajectory rod in place, going through the tape and the hanger.
Q. You mentioned, when looking at "W," that there was a danger zone because there was that jagged edge --
A. Yes.
Q. -- near the lead-in mark.

Do you recall, sir, if the probe -- or if the -- the rod was in that area that you've described as the --

THE COURT: Could you examine him from the microphone?

BY MR. MALONEY: (Continuing)

Q. Do you recall, sir, if the rod was in that danger zone?

A. Just from recalling the photos, it does not look like the rod entered that dropoff zone.

Q. Do you recall if you and Mr. Haag conferred in any way about the placement of that rod in impact "W"?

A. I do not recall conferring with Mr. Haag about that.

MR. MALONEY: Your Honor, we would offer DH41, -42 and -43.

THE COURT: They're received.

BY MR. MALONEY: (Continuing)

Q. You state in your report that the term "rocker point" isn't used in the literature, yet you cite several sources in your report. Do you consider these authorities you've cited to to be reliable authorities in the field of shooting incident reconstruction?

A. Yes.

Q. Mattijssen and Kerkoff's 2016 study, you mentioned that on direct examination.

A. Yep.

Q. What do they say about the lead-in method?

A. They say that the lead-in method is evaluating by putting some -- some millimeters of a rod into a lead-in portion of a defect.

Q. Is that consistent with what Mr. Haag described in his testimony earlier?

A. Yes.

Q. So they used two different names for the same measurement?

A. Oh, sure. Yes.

Q. And are you familiar with Hueske's *Practical Analysis and Reconstruction of Shooting Incidents?*

A. Yes.

Q. 2006?

A. Yes.

Q. You cite to that book, do you not?

A. I do.

Q. And in that book it talks about the shoulder?

A. Yes.

Q. And the shoulder refers to what?

A. In my opinion, similar to the other testifying people. We have to read between the lines of it, but I think he's speaking of the lead-in area, what we've come to know as the lead-in area, which Mike has coined -- Mr. Haag has coined the "rocker method" or "rocker area" for training his students.

Q. And that talks about pressing the tip of the rod into the shoulder?

A. Yes.
Q. And that's the lead-in method?
A. Perhaps. It's unclear if he is pushing the tip of the rod into the shoulder or if he's bringing the rod to meet the shoulder. It's only one line in the 300-, 400-page book, so it's not described adequately, in my opinion, to know what he's exactly doing.
Q. Now, that description, that would be important to determine the vertical angle; correct?
A. Yes.
Q. And if the rod is placed along the lead-in mark, along the centerline of the impact, that's the important placement for horizontal angle; correct?
A. Yes. If the lead-in is fact -- is, in fact, directly in line with the muzzle of the gun and there is no pitch or yaw or deviation, then, yes, the purpose of the horizontal lead-in is it points back toward the origin of the shooter.
Q. And are you familiar with Mr. Haag's *Shooting Incident Reconstruction* book?
A. Yes.
Q. Do you consider that to be a recognized authority in the field of shooting incident reconstruction?
A. Yes, I do.
Q. Do you know Bruce Moran?
A. I do.

Q. Who is Bruce Moran?
A. Bruce Moran is -- I believe he's recently retired. Former forensic scientist from the Sacramento County DA's Office, and he worked in the crime laboratory there for many years and was a firearm and toolmark examiner there.
Q. Do you recognize this book? *Crime Reconstruction* by W. Jerry Chisum and Brent Turvey?
A. Yes, I do.
Q. Is that a recognized authority in the field of shooting incident reconstruction?
A. Yes, it is.
Q. Do you know what Mr. Moran's article in this book says about plus or minus 5 degrees?
A. Yes, I do.
Q. What is that?
A. Mr. Moran, my recollection is, as a side note in the margin, discusses that he believes the plus-or-minus-5-degree range of error is appropriate, and he's basing that on his experience as well as a study he carried out with Mr. Coleman, that they have yet to publish, where they tested the two-point method in drywall panels.

From that, he could adduce -- he's comfortable with plus or minus 5 in that condition.

Q. Now, it's actually in the text of the book on page 259. I only know that because I'm looking at it.

A. Okay.
Q. But you're correct that there is a note, and that's what describes the study in the sidebar. But he actually has it in the text that studies conducted by me and experienced by other examiners suggest that repetitive measurements of predetermined bullet paths are usually within 2 to 3 degrees of target value.
Do you recall his book saying that?
A. Yes.
Q. Do you recall Mr. Moran saying that?
A. Yes.
Q. And you hold Mr. Moran in esteem in this field?
A. Yes. I think he has earned his stripes in the field. I would -- I would question where is Mr. Moran getting his data from? What kinds of impact are we talking about here? This is back to the central problem. If Mr. Moran is talking about solid two-point bullet paths, I agree. We can do two-point bullet paths very well when they're in soft aligned fixed surfaces. No argument from me.
Q. But certainly the skill and experience of the examiner plays a role?
A. I agree.
Q. You wouldn't bring me out to a crime scene and ask me to measure a two-point bullet path; correct?
A. No. Not -- not without direct supervision.
Q. Okay. And so that is an important consideration; right?

A. Yes. The -- the experience of the examiner is important in evaluating how you process bullet holes in a scene.

Q. Do you know Mr. Haag to be one of the leading advocates for the use of the rocker method?

A. Yes, I do.

Q. He teaches it?

A. He does.

Q. He teaches how frequently?

A. I'm not sure of his actual schedule, but I know he has a standing teaching responsibility with the National Firearm Training Academy. They do one segment out of a two-year training program where they go shoot cars. So I know he teaches that at least every year, and he teaches a lot of private courses to various law enforcement agencies throughout the country and internationally as well.

I'm not sure if he was training with Kerkoff and Mattijssen or in Toronto, but I know he does -- he is that well-traveled, so --

Q. You mentioned shooting cars. How frequently do you shoot cars to keep your skills sharp?

A. All the time.

Q. All the time?

A. Yeah. I -- I would -- I would estimate that I'm shooting cars or car parts probably every month or every other month maybe.

Q. And are you using the lead-in method or the rocker method at all in your -- when you shoot cars and take measurements?
A. No.
Q. You have -- have you attended any of Mr. Haag's trainings?
A. Yes.
Q. And did he demonstrate the rocker method to you?
A. Yes.
Q. Was it consistent as he testified today?
A. Well, I don't know. Was it consistent in getting -- obtaining the correct answer? Is that --
Q. In terms of the procedure that he described today, was that consistent with what he trained you in your training class?
A. Yes. It's consistent with his description of the method, yes.
Q. And did he demonstrate it for you?
A. Yes. He has demonstrated it.
Q. And did you practice it?
A. Yes.
Q. How did you do?
A. I didn't feel very confident with the method myself.
Q. You've seen his tests from November and April?
A. Yes.
Q. And those are all plus or minus 5 degrees -- within plus or minus 5 degrees?

A. Yes, that's what he recorded.
Q. And that's the same as what Mr. Haag approves of in normal situations, plus or minus 5 degrees?
A. I think Mr. Haag accepts that in all situations.
Q. My question was about Mr. Moran.
A. Oh, I'm sorry. Please -- please ask that again.
Q. Sure. Mr. Moran approves of the use of plus or minus 5 degrees in most applications?
A. Yes. Yes. That's what he wrote.
Q. Mr. Hueske does, as well, does he not?
A. He does.
Q. There are other methods for trajectory determination that you testified about. Did you try any of those methods to confirm or rebut Mr. Haag's measurements?
A. No.
Q. Did you have access to the vehicle?
A. Yes. I had access to observe Mr. Haag's work.
Q. Were you aware that the vehicle was made available to you in -- in case you wanted to do your own tests?
A. Yes, I -- I don't -- I don't believe I was ever restricted from -- from access to the vehicle. It was up to how the attorneys wanted to use me in their case.
Q. Did you measure the hole on your own?
A. No.
Q. So you couldn't have done the ellipse method?

A. In -- in the -- in Mr. Haag's analysis and when I was there, I did take photographs that would allow the proper perspective of photographs that are required for the ellipse method, and so you can actually evaluate that hole on the ellipse method.

Q. What would -- what information would you learn from the hole using the ellipse method?

A. I believe that you would have a wild large range of error because of the irregularities in the hole.

Q. And let me ask that a different way. Would it give the horizontal or vertical component of that trajectory if you used the ellipse method?

A. It can provide both. It can provide both types of angles, both horizontal and vertical. The position of the ellipse could tell you horizontal; the mathematical would tell us the vertical.

Q. And you would agree, though, that there's a degree of subjectivity with the ellipse method?

A. Yes. It's very sensitive to where you draw the oval around the damage.

Q. Again, the experience and training and -- of the examiner comes into play?

A. Yes.

Q. If you were going to examine a hole and increase your certainty, you would want the most experienced ellipse person

to do that; correct?

A. Yes. I would -- I would not apply the ellipse to this irregular hole. If someone were to use that technique, I would want to see how it is that they're drawing the shape with any confidence because the hole is larger than the bullet.

Q. How would you go about measuring impact "W"?

A. That's a great question. So once you recognize what the -- the hole looks like, in my opinion, I'm going to open up my range automatically. This is a problem hole for me in that I've got very thin metal. I've got an enormous hole relative to the bullet I'm considering, which is .223. I don't even know if it's a .223 bullet. But if I limit that -- I have a very large hole. My second point is very close to my first point, and I have a lead-in. So -- and I have a raised lip that's a bit off axis. I have a long lead-in pinch point.

So when I combine all of those uncertainties, for me, I have -- I'm going to give a larger range. I have to accommodate something that hits as low as creating this long pinch point but also can accommodate if it did come from high enough up to cause some of these other features. I have to consider what is that black stripe going diagonal and is it important? And that my rod is skinnier than my hole and I can move my rod left or right before a centering cone, I have to consider how accurate am I going to be when I -- if I force it to the middle.

So those are the considerations.

So what I would do is, using those parameters as my limits, I would report the -- a larger range of error. I don't know what that range might become, but I would want to make sure that I accommodate all the features of the damage.

Q. So you've clearly given a lot of thought to this hole and your work in this case, and we appreciate your help here today. What range of certainty would you assign to it?

A. That's -- that's the problem. I would -- I would have to evaluate it, and I am a fan of empirical-type testing and seeing what kind of ranges I can sustain and assure that I'm not undercutting the -- the information that the hole can tell me, that the residual hole can tell me, so I don't know what that number would be.

Q. Now, precisely, how would you measure that hole?

A. Well, the 90-degree photographs are going to tell me the dimensions of the hole. I would -- I would have to consider with a rod. I would probably use a rod. I don't think I would use the ellipse method. I would consider something similar to what Hueske is describing, and I think that connecting the rod to an away hole and pressing it to -- into what he calls the shoulder -- we'll call it the lead-in -- will help me establish a minimum, and I could come up from that to try to get the minimums and maximums of the range for the horizontal.

The left/right, it won't be as wide as the entire hole,

but it's going to be something more than just a single straight line perforation because I -- that hole is giving me information that tells me the bullet is fragmenting upon impact. So now I have multiple projectiles going in different directions, and so I have to consider collectively all of that, and it's going to be a problem is where I would be with that.

Q. What is a tag?

A. A tag is a small piece of metal that we see on car -- on the inside of some holes through automobile metal, and it's where a bullet or a fragment has pushed through and -- kind of like opening up a can of soda. The tab folds backward, but it doesn't disconnect completely, and you can kind of see it as a blown-out shelf of metal that is displaced from the passage of a bullet.

Q. Did you see evidence of a tag in impact "W"?

A. I don't recall seeing -- looking at the inside of the damage to defect "W".

Q. You were present in the courtroom today and you saw the interior of the roof liner depicted in court; correct?

A. Yes.

Q. You saw evidence that there were multiple pieces of -- or multiple impacts. Could those have been caused by a tag?

A. I -- I wouldn't call it a tag because technically a tag stays attached. It could be fragments of roof metal causing those additional holes through the liner, or it could be

fragments of bullet or it could be a combination of both of those products pushing forward into the vehicle.

Q. And we know that certain parts of that impact did strike an individual in the car; correct?

A. I understand that someone was -- was struck by something in the car.

Q. But without that, we don't know whether that was a piece of the roof or the bullet; correct?

A. Correct. Or a fragment of the bullet. The bullet I don't believe survived the impact in one piece.

Q. Sir, you -- you would agree that there's no certainties in science?

A. Mostly true. I would mostly agree with that. In forensics, certainly, I agree with the idea that it's -- it's rare to get to say something is always a given -- a given outcome or will absolutely be a given outcome.

Q. And we continue to form hypotheses, test those hypotheses, gather data, and draw conclusions?

A. Yes.

Q. You did none of those things in this case?

A. I did not do any empirical testing in this event.

Q. So without having conducted your own independent test within the field of forensic ballistic analysis, can you conclude to a reasonable degree of certainty that the bullet that caused impact "W" did not strike the truck at the

trajectories calculated by either Mr. Haag or Ms. Dickerson?
A. I know Mr. Haag's opinion about the use of reasonable degree of certainty. It's not something we use in the evaluation. But in the spirit of what you're asking, I cannot eliminate the numbers that are provided by Mr. Haag.
Q. What about Ms. Dickerson?
A. I cannot eliminate those numbers either.
MR. MALONEY: Thank you, sir. No further questions Your Honor.
THE COURT: Any further questions?
MS. FERGUSON: Just a short -- two questions, Your Honor.
THE COURT: I've heard that one before.
MS. FERGUSON: I shouldn't have capped myself at two, but I'll try.

REDIRECT EXAMINATION

BY MS. FERGUSON:
Q. Mr. Noedel, you were shown on cross-examination three photos of the trajectory rod that Mr. Haag placed; correct?
A. Yes.
Q. And those photos had a protractor that you had used on them as well as an inclinometer that you had used; correct?
A. Yes.
Q. But that rod that that protractor was placed next to and

that inclinometer was placed on was not placed by you; correct?
A. Correct. I had nothing to do with the placement of the rod, and those photos were taken after Mr. Haag established what he wanted to do. Because, again, my role was to stay out of his way and observe, so I did not in any way help with the placement of the rod.
Q. And you don't take issue with the manner in which Mr. Haag measured the angles that he reported in this case in terms of using his scanner?
A. No. No. I think that 3D laser scanning, like he used, is a great tool that we're developing in this field to capture the type of data he's -- he's identified.
Q. So you only take issue with the way he placed that rod?
A. Correct. And I'm concerned about the sensitivity and the use of that method to establish rod position.

MS. FERGUSON: I have nothing further.

THE COURT: I asked that you experts get together, if you recall, and so you were present in Bend with Haag at the truck. You watched him do his testing?

THE WITNESS: Yes.

THE COURT: And you didn't go over and try it yourself?

THE WITNESS: No, I did not.

THE COURT: You weren't ordered not to.

THE WITNESS: No. I wasn't specifically ordered not

to, as I recall; but I recall being -- allowing Mr. Haag to do his thing.

THE COURT: All right. But you didn't go over. But you watched him do it?

THE WITNESS: I watched him do it, yes.

THE COURT: Any comment at that time?

THE WITNESS: No. It was not -- sir, it was not my understanding that I was working that process with Mr. Haag.

THE COURT: It was for you -- it was for you two experts to get together -- or the experts to get together and do the experiment together and then report to the Court what you agreed upon and what you didn't agree upon, but apparently that got lost in the translation.

THE WITNESS: Yes, sir. I don't -- I don't recall that being put to me that way.

THE COURT: All right. In any event, have you -- have you tried experimenting with this exhibit?

THE WITNESS: Not that specific exhibit; but, again, I have attended Mr. Haag's courses.

THE COURT: Yeah, okay.

Thank you, sir. It's -- you can step down.

THE WITNESS: Thank you.

THE COURT: Did you have any follow-up?

MR. MALONEY: No, Your Honor. Thank you.

THE COURT: Thank you.

Do we have any further testimony on -- at this time from either side? From the government?

MR. MALONEY: I think we're done in terms of the firearms people, Judge. That was our goal today, was to get through the firearms people.

We do have Mr. Turpen present. We could probably begin his direct examination. We've made arrangements for him to stay the night. He would be available to take tomorrow, if that's --

THE COURT: I -- that's fine. You have further witnesses?

MS. FERGUSON: No, Your Honor. Not today.

THE COURT: Well, any time?

MS. FERGUSON: Yes, we do. We have Mr. Eugene Liscio.

THE COURT: Yes.

MS. FERGUSON: We also have Mr. Clifford Mugnier.

THE COURT: Right. I wasn't sure with the -- who was going to call who. We're all -- we're all set to go.

I'm worried about you. I hope that you will assign closing arguments to somebody else.

She's been a great trouper today, so --

MS. FERGUSON: Thank you.

THE COURT: Don't press your luck.

Then is it okay with everybody, then, if we recess until

tomorrow at 9:00, take the remaining witnesses, followed by the closing arguments? Any problem for the government?

MR. MALONEY: No, Your Honor.

THE COURT: By the defense?

MR. CARY: No, Your Honor. We -- we are concerned we may not finish the evidence tomorrow.

THE COURT: Well --

MR. CARY: We will certainly try.

THE COURT: We've got -- we can take Mr. Turpen now if you're -- how are you holding up, our court reporter?

THE COURT REPORTER: I'm fine.

THE COURT: Let's take a five-minute break, and we'll put Mr. Turpen on the stand.

(Recess taken.)

THE COURT: We'll recess until tomorrow.

(Hearing adjourned.)

C E R T I F I C A T E

United States of America v. W. Joseph Astarita

3:17-cr-00226-JO

EVIDENTIARY HEARING

May 22, 2018

I certify, by signing below, that the foregoing is a true and correct transcript of the record, taken by stenographic means, of the proceedings in the above-entitled cause. A transcript without an original signature, conformed signature, or digitally signed signature is not certified.

/s/Jill L. Jessup, CSR, RMR, RDR, CRR, CRC

Official Court Reporter
Oregon CSR No. 98-0346

Signature Date: 6/11/18
CSR Expiration Date: 9/30/20